HARPOON MISSILE VS SURFACE SHIPS

US Navy, Libya and Iran 1986–88

LON NORDEEN

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INTRODUCTION

Harpoon is the most widely-used anti-ship missile (ASM) in the West, and probably in the world. It enjoys that status for two reasons. Firstly, it was probably the first important Western ASM to exploit the then-new technology of the small, efficient turbojet. This engine gave Harpoon about twice the range of the French Exocet in the same small package. Smallness meant that adding Harpoon to an existing surface ship was relatively easy, in contrast to big Soviet anti-ship missiles.

Secondly, and even more importantly for the US Navy, Harpoon benefited from a brilliant adaptation ordered in 1970. At the time, the US Naval Air Systems Command was developing a missile that US Navy patrol aircraft could use against surfaced Soviet submarines – a "harpoon to hit whales." The submarines were a major threat to US surface vessels. However, they had to remain on the surface to guide their long-range SS-N-3 anti-ship cruise missiles, which in turn made them vulnerable to attack.

OPPOSITE TOP
Admiral Elmo R. "Bud" Zumwalt became CNO in July 1970, and he immediately championed the need for the US Navy to rapidly field an ASM system to counter growing Soviet naval capability. (US Navy)

A Soviet Echo II-class submarine fires a P-5 (SS-N-3) anti-ship cruise missile. These weapons posed a major threat to Western naval forces, but the submarine had to surface to fire the missiles. The ALSAM requirement, which evolved into the Harpoon, was originally developed to give P-3 Orion long-range patrol aircraft the ability to counter this threat. (US Navy)

The patrol aircraft already had shorter-range air-to-surface missiles, but they needed something with much greater reach to catch the Soviet submarines while their own missiles were still in the air. When Harpoon was conceived in 1965, the submarines and long-range Soviet missile bombers were the main threats to the US fleet.

By 1970, the situation had shifted dramatically. The Soviets had deployed a missile-armed surface fleet to the Mediterranean to threaten the US Sixth Fleet in the event war broke out in the unstable Middle East. Soviet missile ships were also deployed elsewhere. The US fleet had no shipboard ASMs of its own – its only counter to Soviet missile ships was carrier-based aircraft armed mainly with bombs. Incoming Chief of Naval Operations (CNO) Admiral E. R. "Bud" Zumwalt, a surface ship sailor, considered the situation unacceptable. The US surface fleet needed some way to stand up to Soviet missile ships. That had to happen as quickly as possible. An existing missile had to be adapted, and Harpoon was chosen.

Many US warships already carried missiles, either anti-aircraft or anti-submarine. Zumwalt's brilliant decision was to require that the new ASM be adaptable to existing launchers. For example, the new missile frigates (Oliver Hazard Perry-class) were to be equipped with a 40-round Mk 13 standard anti-aircraft missile launcher. The new missile could replace anti-aircraft missiles on a one-for-one basis, offering vessels extraordinary anti-ship firepower far beyond the numbers the Soviets fielded. Ships without standard launchers could be given special launchers. The missile was already designed to be carried by aircraft, so it could easily be adapted for use by carrier-based A-6 Intruder bombers. After the US Navy adopted Harpoon as its standard ASM, the Royal Navy wanted to adapt it so that it could be launched by British submarines. The US Navy duly adopted the submarine-launched version.

Perhaps the sincerest compliment to Harpoon was that the Soviets eventually produced a very similar weapon in the form of the SS-N-25. It represented a radical shift in their ASM practice, which had previously favored much larger weapons with more massive warheads. US Navy adoption of Harpoon as a standard ASM guaranteed that it would be made in far larger numbers than any other Western anti-ship missile. Half a century after it was conceived, Harpoon remains in service in evolved forms in as many as 30 countries, on board ships and submarines, on aircraft, and in shore installations. It has also been modified into the air-launched, precision, Standoff Land Attack Missile (SLAM), and SLAM-ER (Extended Range).

Dr. Norman Friedman
June 2023

BELOW
Admiral Zumwalt's masterstroke when it came to rapidly introducing a new ASM to fleet service was to require that the weapon be suitable for firing from existing launchers already installed in frigates, destroyers, and cruisers. These included the Mk 13 standard anti-aircraft missile launcher, with this particular example (complete with a dummy SM-1 missile) being installed in an Oliver Hazard Perry-class frigate. (US Navy)

CHRONOLOGY

1965

Spring US Naval Air Systems Command releases a requirement for an air-launched missile to hit surfaced submarines.

1970

July Admiral E. R. "Bud" Zumwalt becomes the US Navy's CNO, and supports the need for it to rapidly field an ASM system to counter growing Soviet naval capability.

1971

June Secretary of the Navy John Chafee announces that McDonnell Douglas has been awarded a contract to develop the Harpoon.

1972

December 20 First launch of a Harpoon test missile from a P-3A Orion aircraft.

1973

May 3 First launch of a Harpoon from a warship (USS *Lockwood* (FF-1064)).

The Knox-class frigate *Lockwood* fires an early-development Harpoon missile as part of the US Navy's test program for the weapon in 1972–73. (US Navy)

1975

June Harpoon approved for production for the US Navy and international sales.

1977

Summer Harpoon Block 1 Initial Operating Capability with US Navy surface ships.

1982

June Block 1B AGM-84C with improved radar seeker and low-flight capability enters service.

1985

Spring Block 1C AGM-84D with improved range and seeker capabilities enters production.

1986

January US naval forces deploy to the Mediterranean for Freedom of Navigation Operations (FONOPs) in the Gulf of Sidra, off the Libyan coast, as part of Operation *Attain Document*.

March 24

0600 hrs Three US Navy warships sail into the Gulf of Sidra, crossing Col Muammar Gaddafi's so-called "Line of Death" that marked these waters as Libyan territory. Gaddafi previously promised a "military response" if such an act took place.

1352 hrs Two SA-5 surface-to-air missiles (SAMs) are fired from a battery at Misratah at carrier-based F-14 Tomcats covering the three US warships. The SAMs miss. More SA-2s and SA-5s are fired over the next 24 hours.

1600 hrs F-14s from VF-33 challenge Libyan Arab Air Force (LAAF) MiG-25s in a series of inconclusive engagements before the MiGs return to base.

1830 hrs Operation *Prairie Fire* commences when aircraft from USS *Coral Sea* (CV-43), USS *Saratoga* (CV-60) and USS *America* (CV-66)

An A-6E from VA-55 recovers aboard *Coral Sea* on March 22, 1986, just 48 hours prior to Operation *Prairie Fire*. The aircraft carries a typical SUCAP load, consisting of two Rockeye CBUs and an AGM-84, plus an AIM-9 Sidewinder for self-protection. (US Navy)

are launched in an attack on SA-5 sites at Misratah, but the strike is aborted when the jets are engaged by three more SAMs.

2017 hrs La Combattante IIG-class fast attack craft *Waheed* of the Libyan Navy is engaged by two Harpoon-equipped A-6E Intruders from VA-34, embarked in *America*. It is disabled by a single AGM-84 and then sunk by a second Harpoon and Mk 20 Rockeye cluster bomb units (CBUs).

2150 hrs An A-6E from VA-85 engages the Nanuchka II-class corvette *Ain Mara* with Rockeye CBUs (rather than Harpoons, due to civilian surface vessels in the area). The warship limps back into port.

2350 hrs Leahy-class cruiser *USS Richmond K. Turner* (CG-20), acting as an anti-aircraft picket ship for the battle groups, fires an RGM-84A at an unidentified Libyan patrol boat (possibly another La Combattante IIG-class vessel) at a range of 50 miles. The ship claims a hit, but the E-2C tracking this engagement reports no radar contact, and no debris is subsequently seen in the water by two Intruders sent to visually search the area.

March 25

0005 hrs Ticonderoga-class cruiser USS *Yorktown* (CG-48) fires two RGM-84As at a contact, claiming hits on an unidentified Assad-class corvette. In reality, radar operators on board *Yorktown* may have misclassified an aerial contact as a surface target.

0600 hrs A-6Es engage the Nanuchka II-class corvette *Ain Zaquit*, a jet from VA-55 (embarked in *Coral Sea*), hitting it with Rockeye CBUs and an Intruder from VA-85 then inflicting mortal damage with a single Harpoon. Single Rockeye CBUs dropped from two more VA-85 aircraft finish the corvette off. *Prairie Fire* is terminated shortly after this engagement, by which time the Libyans have had 72 servicemen killed, one corvette and one patrol boat sunk, a second corvette crippled, and a patrol boat damaged. Several SAM sites have also been destroyed or damaged.

1987

May 17 Oliver Hazard Perry-class frigate *USS Stark* (FFG-31), sailing in the central Persian Gulf off the Saudi Arabian coast, is hit by two AM.39 Exocet ASMs fired from an Iraqi aircraft (possibly a modified Falcon 50 business jet). Although damage control parties prevented the ship from sinking, 37 crew were killed in the attack.

1988

April 14 Oliver Hazard Perry-class frigate USS *Samuel B. Roberts* (FFG-58) hits an Iranian mine in the Persian Gulf.

April 18

0804 hrs In retaliation for the mining of *Samuel B. Roberts*, the US Navy commences Operation *Praying Mantis* when Surface Action Group (SAG) Bravo, consisting of the Spruance-class destroyer USS *Merrill* (DD-976), the Charles F. Adams-class destroyer USS *Lynde McCormick* (DDG-8), and the Austin-class amphibious transport dock USS *Trenton* (LPD-14), shell Iranian guns and military installations on the Sassan gas/oil separation platforms (GOSPs).

0815 hrs SAG Charlie, consisting of the Belknap-class cruiser USS *Wainwright* (CG-28), the Oliver Hazard Perry-class frigate USS *Simpson* (FFG-56), and the Knox-class frigate USS *Bagley* (FF-1069), shell Iranian guns and military installations on the Sirri-D GOSP.

1048 hrs US intelligence ascertains that Islamic Revolutionary Guard Corps Navy (IRGCN) Boghammer-class speed boats and a missile-capable corvette have left the port of Bandar Abbas to patrol the eastern Persian Gulf and defend the Sirri-D GOSP.

1100 hrs A-6Es from VA-95, embarked in USS *Enterprise* (CVN-65), spot Boghammer-class speed boats firing on vessels in the Mubarek oil field, southeast of Abu Musa Island off the coast of the United Arab Emirates (UAE). Three Boghammers are damaged in a single attack with Rockeye CBUs.

1145 hrs Sensors on board *Wainwright* detect electronic "chatter" from a Mk 92 fire-control system, indicating a modern-era warship is in the area.

1200 hrs An SH-2 helicopter from *Bagley* detects the Kaman-class fast attack craft *Joshan*, armed with Harpoons.

1215 hrs *Joshan* fires an RGM-84A at *Wainwright*, but this is defeated by chaff, heavy electronic countermeasures, or systems failure. *Simpson* hits *Joshan* with single Standard SM-1MR surface-to-surface missiles (SSMs) at 1215 hrs, 1217 hrs, and 1223 hrs and *Wainwright* fires a SM-2MR at 1226 hrs.

1250 hrs *Wainwright* fires two Standard-ER SM-2 missiles at an Islamic Republic of Iran Air Force (IRIAF) F-4 Phantom II attempting to attack the vessel. The aircraft is damaged by the first SAM and returns to Bandar Abbas airfield.

1350 hrs *Simpson* fires a final SM-1MR SSM at *Joshan* after detecting EW emissions from the vessel.

1358 hrs *Bagley* just misses the hulk of *Joshan* with a single RGM-84A after being ordered to finish the vessel off by *Wainwright*.

1459 hrs Saam-class frigate *Sahand* departs Bandar Abbas. SAG Delta, consisting of the Spruance-class cruiser USS *O'Brien* (DD-975), the Oliver Hazard Perry-class frigate USS *Jack Williams* (FFG-24), and the Charles F. Adams-class guided missile destroyer USS *Joseph Strauss* (DDG-16), are ordered to search for the frigate.

The Saam-class frigate *Sabalan* of the IRIN on patrol in the Strait of Hormuz in the early 1980s, prior to its involvement in the Tanker War. (US Navy)

1530 hrs Having spotted *Sahand* leaving port, a lone A-6E from VA-95 attacks the frigate with a Harpoon and two AGM-123 Skipper IIs – the Intruder crew spot flashes from SAMs being fired at them as they pass by the ship.

1540 hrs Another A-6 and six A-7Es from *Enterprise* target *Sahand*, with the Intruder also achieving a single hit with a Harpoon. An RGM-84 fired by *Joseph Strauss* also hits the frigate at this time. The Iranian vessel sinks several hours later after being struck by both missiles and bombs.

1621 hrs *Joshan* sinks after being shelled by SAG Charlie. Saam-class frigate *Sabalan* leaves Bandar Abbas shortly thereafter.

1642 hrs US forces report Silkworm SSMs inbound towards *Jack Williams* and other vessels. These are defeated by chaff and maneuvering. The Oliver Hazard Perry-class frigate USS *Gary* (FFG-51), in the northern Persian Gulf, also defeats Silkworm SSMs. The Pentagon later denies there were any such attacks.

1717 hrs *Sabalan* fires several SA-7 SAMs at two Intruders and one of the aircraft hits the frigate with a single laser-guided bomb. The vessel is left motionless in the water, at which point the day-long war-at-sea against Iran is halted by direct orders from the Pentagon.

MISSILE DESIGN AND DEVELOPMENT

In the spring of 1965, US Naval Air Systems Command released a requirement for an Air-Launched Ship Attack Missile (ALSAM) with a range of 24 nautical miles to target Soviet "Echo" and "Juliet" class submarines that had had to surface to fire their long-range ASMs. A little over two years later, on October 21, 1967, the effectiveness of Soviet ASMs was shown when the Israeli destroyer *Eilat* was sunk off Port Said, in the Mediterranean, by three Soviet P-15 Termits (NATO codename SS-N-2 "Styx") fired from Egyptian Komar-class missile boats. This event sent shockwaves through the US Navy, whose senior officers had underplayed the potency of Soviet anti-ship SSMs.

Nevertheless, the ALSAM requirement made slow progress until July 1970, when the then-new US Navy CNO Admiral E. R. "Bud" Zumwalt called for the rapid development and wide deployment of an all-weather anti-ship missile to counter Soviet superiority in naval cruise missiles. The CNO subsequently announced the "Project Sixty" initiative on September 16, stating:

> This weapon's capability will give our ships a reach comparable to that of the Soviets and cut their advantage in that respect. With the carrier force level reduced, our ships cannot always count on air support, and this action will increase our flexibility in the employment of all our forces. A proposal will be made to accelerate delivery of the missile system, which can be launched from either aircraft or ships against surface targets.

In January 1971, US Naval Air Systems Command announced it would take bids for a 60 miles-plus range missile to be known as the "Harpoon." Six teams responded, and McDonnell Douglas and General Dynamics were selected as semi-finalists in May 1971. The US Navy decided against competitive prototyping of the missile system to conserve funds and speed development. McDonnell Douglas was awarded the contract in June 1971. Harpoon was designed from the start to be a "total weapons system" that included the missile, various launchers, command and launch subsystems, training and support.

The Harpoon program was initially planned to follow a three-step process – design, weapons systems development, and pilot production. At the May 1973 Defense Acquisition Review Committee meeting, the US Navy expanded the scope of the Harpoon program after deconflicting with other missile programs (Condor for aircraft and Active Standard for ships). It added the requirement that the Harpoon needed to be air-launch capable, thus finally providing the US Navy with an ALSAM. The A-6 Intruder was identified as the primary carrier-based aircraft for Harpoon employment.

Initially, the Harpoon program went according to plan and tracked on budget. Some 36 development and test missiles were fired from ships (RGM-84) and aircraft (AGM-84) between October 1972 and June 1975, with 31 judged successful. However, the program experienced challenges during the operational evaluation phase in 1975–76, with missiles and other systems demonstrating performance deficiencies. As a result, the Harpoon Operational Evaluation (OPEVAL) was delayed for seven months as the US Navy and contractor teams made missile and launch system improvements. The missile, launch systems, and test equipment finally passed OPEVAL in late 1976. Harpoon Block 1 was approved for full rate production for the US Navy and foreign customers, with the delivery of production examples of the AGM-84 (aircraft), RGM-84 (surface ships and coastal defense batteries), and UGM-84 (submarines) commencing in 1977.

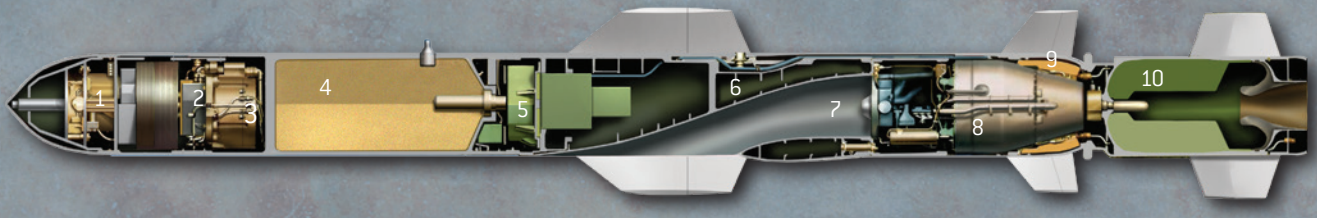
HARPOON IN DETAIL

The Harpoon missile incorporates a guidance section, warhead, fuel, turbojet propulsion and power components and control section. The nose of the missile includes a coated plastic radome and Texas Instruments (later Raytheon) AN/DSQ-28 active radar seeker which provides terminal guidance. The seeker, when activated, searches for, tracks and locks on to the first significant target detected. Designed to overcome a wide variety of decoys and jammers, the seeker randomly changes frequency and has been designed to have strong electronic counter countermeasures (ECCM) features. The DSQ-28's 79-lb phased array antenna can rotate through 45 degrees in any direction.

Prior to activation of the terminal guidance seeker, the missile is controlled by a Lear Siegler attitude reference system and an IBM computer autopilot. A Honeywell or Kollsman AN/APN-194 radar altimeter feeds missile altitude to the computer to maintain sea-skimming flight.

The Harpoon has a 488-lb semi-armor piercing high explosive blast penetration warhead designed by the Naval Weapons Center at China Lake, California. It includes a hardened steel case to allow for penetration through bulkheads and 215lbs of Destex high explosive material.

RGM-84 HARPOON



1. Seeker
2. Mid-course guidance unit
3. Radar altimeter
4. Warhead
5. Main battery
6. Fuel tank
7. Turbojet engine air inlet
8. Teledyne CAE J402 turbojet engine
9. Control actuators
10. Thiokol/Aerojet solid rocket booster

The range requirement of the Harpoon (more than 50 nautical miles), as opposed to the earlier ALSAM (25 miles), mandated the use of an air-breathing turbojet rather than rocket propulsion. The center and aft section of the Harpoon contain batteries providing electric power to the missile, a tank holding 100lbs of jet fuel, the wings and a Teledyne CAE J402-CA-400 turbojet engine weighing 101.5lbs – the latter was designed specifically for use in the Harpoon. At launch, a set of explosive charges spin up the turbojet to its output of 660lbs of thrust in five seconds.

When launched from surface ships, submarines or land batteries, the Harpoon is equipped with a rocket booster to achieve sufficient velocity for the turbojet to activate. The Thiokol/Aerojet booster generates 12,000lbs of thrust, which lasts for three seconds. Booster separation occurs at an altitude of about 1,300ft, after which the missile descends until it reaches cruise level.

Harpoon direction control is provided by a set of four aluminum fins, mounted on the rear of the missile body. Electrical actuators move the fins up to 30 degrees in response to commands provided by the central computer and radar seeker.

One of the major advantages of the Harpoon is its fire and forget capability. At a point set on the command-and-control system before launch, the Harpoon will activate and then fire. The missile then descends to its lowest possible flight level. During the final phase of flight, the seeker will search for and lock on to the target. The AGM/RGM-84A1 variant that entered service in 1977 was programmed to pop up close to the target

An RGM-84 Harpoon is fired from an ASROC launcher aboard the Knox-class frigate USS *Badger* (FF-1071) during a missile exercise off Hawaii in July 1980. The Pearl Harbor-based vessel was one of the first Knox-class frigates to field the Harpoon operationally. (US Navy)

The Mk 141 canister launcher was developed by the US Navy and installed on a wide range of vessels. Typically, eight canisters were fitted to larger ships, usually divided into two clusters of four as seen here on board USS *Leahy* (CG-16) in 1983. The Mk 141s had replaced the cruiser's 3-in. gun mounts during an overhaul in 1981. *Leahy*'s sister-ship *Richmond K. Turner*, also equipped with Mk 141 launchers, subsequently became the first US Navy vessel to fire an RGM-84 in anger on March 24, 1986 during *Prairie Fire*. (US Navy)

and then fly a 30-degree dive to evade terminal defenses. The Royal Navy's submarine-launched UGM-84B variant introduced sea-skimming flight until impact at a slightly lower cruise altitude. Later, improved Harpoon versions could fly to waypoints, enabling missiles to pass over ships or land features to approach targets from multiple directions, before descending to low-level until impact or selecting to fly a pop-up attack.

The Harpoon is designed to be able to be fired from surface ships, aircraft, and submarines. US Navy surface ships used the Mk 16 ASROC (Anti-submarine Rocket) launcher on Knox-class frigates and Mk 11/13 Tarter/Standard launchers on Charles F. Adams-class destroyers and Oliver Hazard Perry-class frigates. Later, the Mk 141 canister launcher was developed with a total of eight Harpoon missiles for installation on a wide range of vessels including Pegasus-class hydrofoils, frigates, destroyers, cruisers, and even battleships. Export customers have mounted the Harpoon system in canister launchers on dozens of classes of warships, as well as on trucks for use in coastal defense mode.

The AGM-84 Harpoon variant was initially cleared for use by the US Navy's A-6 Intruder, P-3 Orion, S-3 Viking, F/A-18 Hornet and, later, the F/A-18E/F Super Hornet and P-8A Poseidon. The US Air Force could also equip its B-52G/Hs with up to 12 Harpoons. Export customers also acquired AGM-84s in large numbers, with the F-111C, F-15 Eagle, F-16 Fighting Falcon, Nimrod, P-3 and Fokker F27 Maritime Enforcer and Fokker 50 all being cleared to operate the missile.

The UGM-84 has armed US Navy Sturgeon-, Permit-, and Los Angeles-class attack submarines, as well as vessels from a number of foreign navies. This variant of the missile is installed in an unpowered buoyant capsule and fired from a standard torpedo tube. When the capsule reaches the surface, the nose and tail caps are released and the missile is blasted from the tube by its booster.

All of the Harpoon missile bodies delivered from the assembly line in Saint Charles, Missouri, are similar, but with different wings, fins, and attachment points fitted depending on the intended launch platform. As previously noted, the RGM-84 is the ship- (or land-) launched version and the UGM-84 is for use by submarines – both are fitted with rocket boosters. Finally, the AGM-84 is the air-launched version, with no booster.

The Harpoon Command and Launch Control System provides graphic displays and automatic engagement planning for operators to select flyout routes and seeker search modes to optimize performance, prior to powering up and firing the missile. Targeting data for the weapon comes from a variety of sources including aircraft, helicopters, data links, visual search, sonar, radar, or other options.

YS-3A prototype BuNo 157992 participated in the early flight trials of the AGM-84 in the 1970s. The aircraft was fitted with a wingtip-mounted camera to document the missile's release from the aircraft's port wing stores pylon. The Viking was one of a handful of US Navy aircraft to subsequently include the Harpoon within its arsenal. (US Navy)

Although Harpoon launch systems for ships, aircraft, submarines, and land batteries have been routinely upgraded, the US Navy soon realized that greater strides in the weapon's effectiveness could be realized if improvements were made to the weapon itself. This point was emphasized by then-CNO Admiral Thomas B. Hayward when he made the following statement during a Congressional hearing in 1980:

> We have reached the point where there is more leverage in improving the weapon, making it smarter, longer-legged and more capable of self-direction, than trying to achieve the same results through improvement of the launch platform.

The US Navy and McDonnell Douglas made a major commitment to rapidly develop and deploy the Harpoon. By 1981 more than 100 US Navy ships, 25 P-3Cs, and 23 attack submarines had been equipped with the weapon. The missile had also been exported to Australia, Canada, Denmark, Greece, Iran, Israel, Japan, Pakistan, Portugal, Saudi Arabia, South Korea, and Spain.

Admiral Hayward's statement of intent in respect to upgrading the Harpoon resulted in the development of the Block 1B AGM/RGM/UGM-84C, which entered service from 1982. The missile's principle advantage over the Block 1 weapon were its ability to sea-skim all the way to the target thanks to seeker enhancements. Then, in 1985, the AGM/RGM/UGM-84D Block 1C Harpoon was introduced, with seeker ECCM upgrades, waypoint capability and greater range thanks to expanded fuel storage and the use of more powerful JP-10 jet fuel. Block 1A, 1B and 1C weapons were used by US Navy warships and aircraft during Operations *Prairie Fire* and *Praying Mantis*, while the Islamic Republic of Iran Navy (IRIN) fired a single Block 1 RGM-84A during the April 1988 action.

ASM DEVELOPMENT

As noted in the Introduction to this book, the development of the Harpoon was spurred on by the wholesale embracing of the guided ASM by the Soviet Union.

A UGM-84 accelerates away from its launch canister, the latter having been fired from the forward torpedo tube of a submerged submarine off the coast of southern California during trials in the Pacific Missile Range Facility. The canister can be seen breaching the surface of the water, while its discarded nose plug is at the top left of the photograph. (US Navy)

OPPOSITE TOP

The Ticonderoga-class cruiser USS *Gettysburg* (CG-64) launches an RGM-84 from a Mk 141 launcher at ex-USNS *Saturn* (T-AFS-10) during a sinking exercise off North Carolina on October 27, 2010. *Gettysburg*'s sister-ship *Yorktown* also fired a Harpoon during *Prairie Fire*. (US Navy)

The weapon's main proponent was Admiral Sergei Gorshkov, who was appointed commander-in-chief of the Soviet Navy in 1956. Tasked with making the service capable of defending the USSR from strikes by US Navy carriers, he replaced roughly 300 obsolescent warships with newly-built missile boats armed with powerful ASMs. These weapons were also capable of being launched from bombers, submarines, and coastal defense batteries. Larger Soviet strategic missile systems included the supersonic P-35/P-6 (SS-N-3 "Shaddock"), Kh-22N (AS-4 "Kitchen"), and similar weapons armed with nuclear or large high-explosive warheads.

The Soviet Navy also deployed a mix of tactical weapons such as the ship- and land-launched P-15 Termit (SS-N-2 "Styx"), submarine-launched P-70 Ametist (SS-N-7 "Starbright"), submarine- and ship-launched P-120 Malakhit (SS-N-9 "Siren"), the supersonic P-270 Moskit (SS-N-22 "Sunburn"), and the Harpoon-like KH-35 Uran (SS-N-25 "Switchblade"). The P-15 was the most widely exported Soviet SSM, being supplied to more than 20 countries. "Styx" was also built in China, with upgraded versions being fielded and exported.

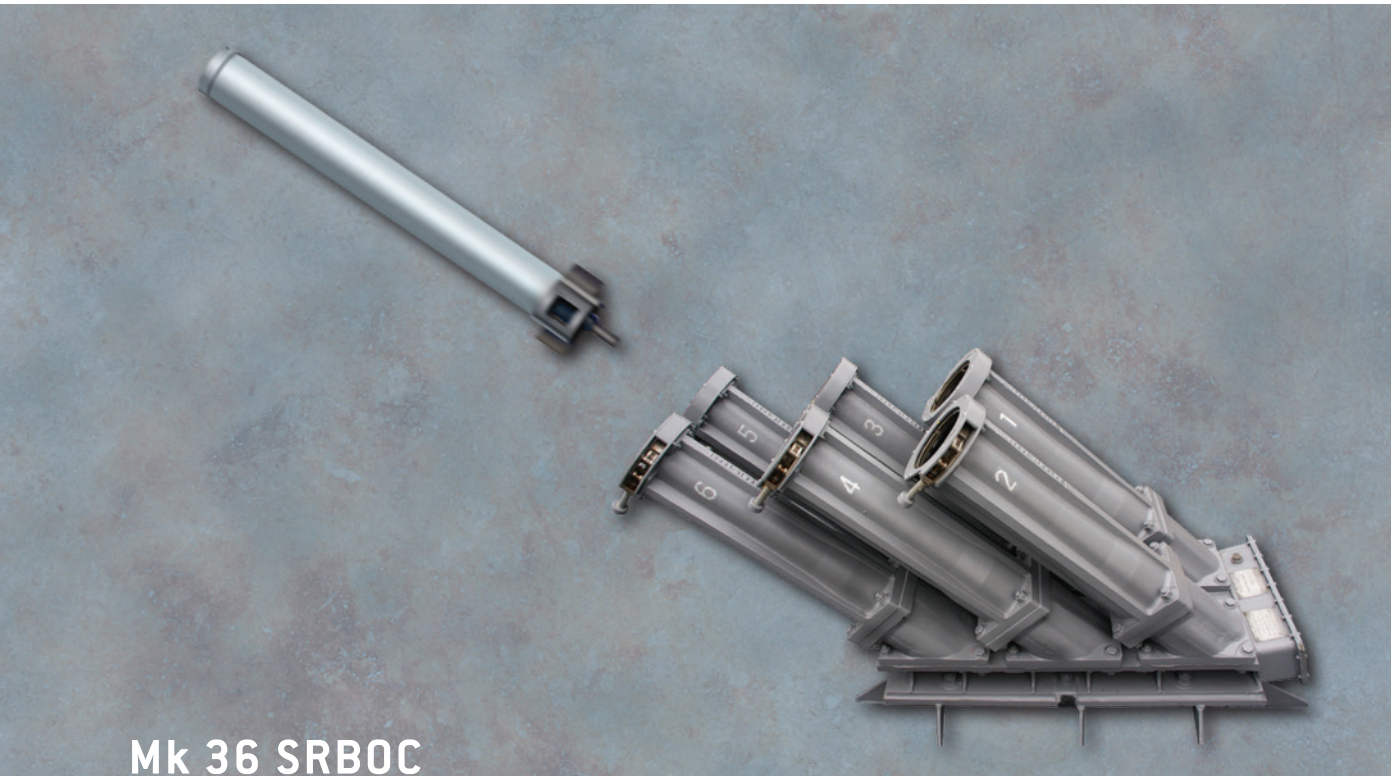
Although naval forces in the West developed missile-based air defense systems during the 1950s, they refused to embrace ASMs. The Swedish and French navies were the first to follow the Soviet lead when Saab and Nord (later Aérospatiale) modified the CT-20 target drone into the Rb 08. Examples were fitted to Swedish naval vessels from 1955. That same year, the French commenced development of what would eventually become the Exocet (Flying Fish) ASM. Norway and Italy also started work on their own ASMs in the early 1960s, with the end result being the Penguin and Sea Killer missiles (the latter weapon being bought by Iran for its Saam-class frigates), respectively. Israel had already commenced development of its own ASM in the form of the Gabriel missile prior to the loss of *Eilat* to a "Styx" in October 1967.

As already noted, the sinking of *Eilat* forced senior naval officers in the West to acknowledge the threat posed by Soviet ASMs. The development of a new generation of such weapons duly followed, with the longer range, turbojet-powered Harpoon, Italian Otomat, Swedish RBS-15, British Sea Eagle, and other similar ASM systems all eventually entering service by the late 1970s.

It is important to note that the relatively small, subsonic Harpoon (and many similar Western ASMs) followed a different design philosophy to the big, often supersonic weapons developed by the Soviet Union. Many of the latter were fighter-sized supersonic missiles (some nuclear armed). They relied on numbers and speed to

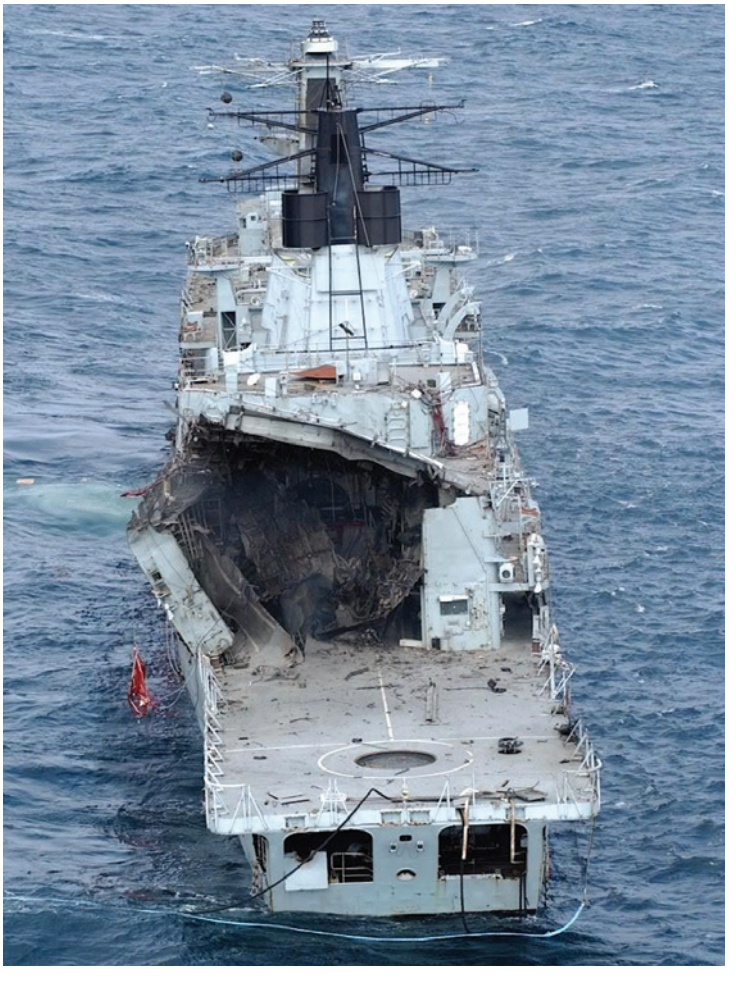
overwhelm defenses. The US Navy's approach was to employ large numbers of smaller but more sophisticated "sea-skimming" ASMs that relied on delayed detection to penetrate terminal defenses and strike their targets from multiple directions.

The proliferation of ASMs significantly changed naval warfare. Missiles launched from surface ships, small fast attack craft, submarines, aircraft, and mobile land launchers could sink large vessels. ASMs have greater range, lethality, and accuracy than torpedoes, bombs, and cannon fire. During the past five decades, more than 400 ASMs are known to have been fired in anger. These weapons have been employed with success in the War of Attrition (1967–70), Indo–Pakistan War (1971), Arab–Israeli War (1973), Falklands War (1982), Iran–Iraq War



Mk 36 SRBOC

The Mk 36 Super Rapid Bloom Offboard Countermeasures Chaff (SRBOC) and Decoy Launching System is an evolutionary development of the RBOC family with enhanced capability. It is a deck-mounted, mortar-type countermeasure system that can be used to launch an array of chaff cartridges against a variety of threats. The purpose of the system is to confuse hostile missile guidance and fire control systems by creating false signals. The launching system is controlled from the CIC, and its use is dependent on information provided by the detection and threat analysis equipment on the ship.



The ex-Royal Navy frigate HMS *Boxer* was sunk as a target in the Western Approaches in August 2004, the vessel being hit by two Harpoons in the engine room and hangar bay. *Boxer* was also struck by naval gunfire and helicopter-launched Sea Skua ASMs. It was eventually sunk by a demolition team that was sent aboard to finish the warship off. (Public Domain)

(1980–88), and many other conflicts and naval engagements since then. According to Iranian sources, the first operational use of a Harpoon missile was on the night of 22–23 October, 1980 during the Iran–Iraq War when the Iranian Navy's Kaman-class fast attack craft *Joshan* hit an Iraqi Osa-class vessel with a single RGM-84 in the Northern Arabian Gulf.

DEFENDING AGAINST ASMs

Detection, and tracking of ships and possible ASM threats, are critical steps for an ASM engagement. Naval search radar on a ship mast can see out to about 15 miles due to the curvature of the earth. A sea-skimming missile flying at 33ft above the sea can be detected at 15 to 18 miles, which can then provide 30 to 60 seconds of warning time for the crew – less if the vessel has been targeted by a supersonic missile. High sea states, darkness, wind, rain, and other conditions make it harder for radar and other sensors to detect incoming missiles. Airborne early warning systems, aircraft, satellites, helicopters, ships, and submarines can use radar, sonar, infrared (IR), and visual contact to detect and confirm potential threats and alert defenses.

To accurately fire an ASM, the launch platform needs bearing information and hopefully some indication of range. Longer-range ASM systems require a midcourse guidance update to adjust for target movement.

In order to avoid being attacked by an ASM, crews are trained not to let their ship be detected or tracked and, if required, to "shoot the archer, not the arrow." If fired upon by an adversary, they must engage with their defenses and then evade. Decoys and countermeasures are used to disrupt or deflect ASMs and, as a final resort, terminal close-in weapons systems can shoot them down.

Many supersonic ASMs (like the SS-N-3) fly at higher altitudes for a portion of their attack profiles, and thus can be detected at longer ranges. Threat aircraft and missiles can be taken under fire by fighters, SAMs, or ship-mounted guns. Naval forces have also invested in electronic warfare sensors and other warning systems to detect ships, aircraft, and missiles. Once an incoming ASM is detected, the crew of a warship will counter with maneuver, active defenses, jammers, chaff, IR decoys, and other tactics to try disrupt an attack.

SHIP AND AIRCRAFT TECHNICAL SPECIFICATIONS

In this chapter, brief histories and technical specifications for the various surface ships and aircraft involved in the Harpoon missile actions off Libya in 1986 and Iran in 1988 are provided. Only a small number of Harpoons were expended in Operations *Prairie Fire* and *Praying Mantis* by four ships and one aircraft type. The weapons in turn struck three vessels, while a fourth (*Joshan*) had itself fired an RGM-84A just moments before being hit by multiple standard SSMs..

USS *Richmond K. Turner* (CG-20)

The first US warship to fire an RGM-84 Harpoon in combat was USS *Richmond K. Turner* (CG-20) at 2350 hrs on March 24, 1986 during Operation *Prairie Fire*. The fifth of nine "double-ended" Leahy-class guided-missile frigates built between December 1959 and June 1964, *Richmond K. Turner* was the last of its class to be commissioned into service on June 13, 1964. The warship's primary armament was the Standard-ER SM-2 SAM, fired from single twin-rail Mk 10 Mod 5/6 launchers forward and aft. Assigned to the Pacific Fleet in San Diego, California, the vessel completed four combat deployments with Task Force (TF) 77 in the South China Sea during the conflict in Vietnam.

Sailors man the rails aboard *Richmond K. Turner* as the cruiser enters port at Charleston, South Carolina, to mark the end of a six-month deployment to the Persian Gulf in 1987–88. The vessel helped protect US-flagged merchant ships as part of Operation *Earnest Will* during the cruise. The port Mk 141 launcher can be seen immediately aft of the superstructure. (US Navy)

Following a refit in 1971–72, during which the ship's anti-aircraft warfare (AAW) capabilities were improved, *Richmond K. Turner* joined the Atlantic Fleet. In July 1975 all Leahy-class vessels were redesignated as cruisers, and with a full weight of 8,200 tons, they were the smallest warships in the US Navy at the time to be given this classification. Following a series of Mediterranean cruises with Sixth Fleet, *Richmond K. Turner* spent an extended period being overhauled in 1977–78. As part of the refit, its two 3-in. anti-aircraft twin mounts amidships were replaced by two quad Mk 141 Harpoon canisters. In July 1979, while again assigned to Sixth Fleet, *Richmond K. Turner* became the first deployed US Navy warship to fire a Harpoon when it destroyed a target ship at a range of 78 miles whilst exercising in the Gulf of Sidra.

A further six deployments to the Mediterranean were undertaken in the 1980s, including the 1986 cruise that saw the vessel play a central role in both Operations *Attain Document* and *Prairie Fire*. At 2350 hrs on March 24, 1986, whilst acting as an anti-aircraft picket ship for the carrier battle groups, *Richmond K. Turner* approached the Libyan coastline near Misurata following reports from F-14 crews that they had been fired upon by AAA and acquired by fire-control radars whilst manning a nearby Combat Air Patrol station.

The cruiser picked up an unidentified surface contact (possibly another La Combattante IIG-class vessel) at a range of 50 miles and fired a single RGM-84A. The ship claimed a hit, but the E-2C tracking this engagement reported no radar contact, and no debris was seen in the water by a pair of Intruders that visually searched the area.

Two years later, *Richmond K. Turner* also participated in Operation *Earnest Will*, which saw US Navy warships protect Kuwaiti-owned supertankers from Iranian attacks during the Tanker War phase of the Iran–Iraq conflict.

Thanks to modernization programs (including the comprehensive New Threat Upgrade, which *Richmond K. Turner* received in 1988–89), the Leahy-class cruisers remained key AAW vessels. This, in turn, meant that they were routinely assigned to

carrier battle groups operating in the Mediterranean and, increasingly, in the Persian Gulf. As a primary AAW unit within the USS *Theodore Roosevelt* (CVN-71) battle group, *Richmond K. Turner* helped provide protection for four US Navy carriers during Operation *Desert Storm* in January–February 1991. It also provided AAW support for aerial assets involved in the relief effort for Kurdish refugees, codenamed Operation *Provide Comfort*, that commenced in April of that year.

Richmond K. Turner made a final deployment as part of the *Theodore Roosevelt* battle group in 1993, during which time it served as an AAW command vessel during Operation *Deny Flight* – the NATO enforcement of the UN no-fly zone over Bosnia-Herzegovina that commenced in April 1993. Decommissioned on April 13, 1995, the ex-*Richmond K. Turner* was sunk as a target near Puerto Rico on August 9, 1998.

USS *Yorktown* (CG-48)

Just 15 minutes after *Richmond K. Turner* fired a single Harpoon in *Prairie Fire*, USS *Yorktown* (CG-48) expended two RGM-84s. The second of 27 Ticonderoga-class guided-missile cruisers constructed between 1980 and 1994, *Yorktown* was commissioned on July 4, 1984 and issued to the Atlantic Fleet. Part of the largest cruiser class built by any navy since World War II, the 9,859-ton vessel was fitted with the cutting-edge Aegis combat system centered on the AN/SPY-1A multipurpose phased array radar. Thanks to the latter, the Ticonderoga-class cruisers were the world's most capable AAW ships when they entered service.

Unlike the other US Navy vessels to fire Harpoons in anger, *Yorktown* was RGM-84-capable from the outset. Like all Ticonderoga-class cruisers, it was fitted with two quad Mk 141 Harpoon canisters on the stern. The RGM-84 was the only missile unable to be fired by *Yorktown*'s twin Mk 26 Mod 1 launchers (or the two Mk 41 Mod 0 VLSs fitted in the majority of the class) located forward and aft, the latter being used by Standard-MR SM-2s and RUR-5 Anti-Submarine Rockets (ASROCs).

Yorktown's first deployment, as part of the *Saratoga* battle group, was undertaken between August 1985 and April 1986. The vessel was involved in the *Achille Lauro* hijacker interception in the Mediterranean on October 10, 1985, helping to guide F-14s from *Saratoga*'s Carrier Air Wing (CVW) 17 into position to force an EgyptAir Boeing 737 carrying the terrorists to land at the NATO air base at Sigonella, on Sicily.

Yorktown was the second US Navy warship to fire a Harpoon during *Prairie Fire*, the cruiser shooting two RGM-84s from one of its two Mk 141 launchers clearly visible on the stern in this photograph. Although the ship's crew claimed the weapons hit an unidentified Assad-class corvette, the US Navy's Office of Naval Intelligence later concluded that operators of the ship's AN/SPY-1A radar may have misclassified an aerial contact as a surface target. (US Navy)

Between January 26–30 and February 12–15, 1986, it was one of a number of vessels from Sixth Fleet to participate in Operations *Attain Document I* and *II* aimed at exercising the US Navy's right to FONOPs in the Gulf of Sidra. Both operations passed off without incident, but shortly after *Attain Document III* commenced on March 23, by which point Sixth Fleet had amassed a force consisting of three carriers, five cruisers, 12 destroyers, six frigates, and more than 250 aircraft in the central Mediterranean, Libyan surface vessels engaged US Navy warships. Operation *Prairie Fire* lasted less than 24 hours, and at 0005 hrs on March 25, *Yorktown* fired two Harpoon missiles at what its crew believed was an Assad-class corvette. The US Navy's Office of Naval Intelligence later concluded that operators of the ship's AN/SPY-1A radar may have misclassified an aerial contact as a surface target.

During *Yorktown*'s second Mediterranean deployment in 1987–88, the vessel again made international headlines when the Soviet frigate *Bezzavetnyy* intentionally collided with the cruiser on February 12, 1988 whilst the US Navy warship was conducting FONOPs in the Black Sea. *Yorktown* spent the first half of the 1990s undertaking routine Mediterranean cruises with Sixth Fleet, and immediately after *Desert Storm* it provided AAW support for aerial assets during Operation *Provide Comfort*. For six months from August 1994, the cruiser served as the flagship for both the Commander, Standing Naval Force Atlantic, in support of the UN embargo of Yugoslavia and the Air Warfare Commander for the Adriatic Sea.

From 1995 through to 2000, *Yorktown* undertook a series of counter-narcotics deployments to the Caribbean Sea whilst assigned to Second Fleet. The vessel completed its final cruise in 2004 as part of the USS *Wasp* (LHD-1) Expeditionary Strike Group, during which time *Yorktown* supported Operations *Iraqi Freedom II* and *Enduring Freedom*. The cruiser was decommissioned on December 3, 2004 and scrapped in 2022–23.

IRIN *Joshan* (P225)

The only Harpoon missile to ever be fired in anger at an active US Navy warship was a single RGM-84A expended by the Kaman-class fast attack craft *Joshan* of the IRIN on April 18, 1988. This vessel was one of 12 La Combattante IIA-class fast attack craft ordered by the Imperial Iranian Navy (IIN) in two batches of six in February 1973 and October 1974.

Joshan was built by the Constructions Mécaniques de Normandie (CMN) shipyard in Cherbourg in 1976–77, with the IIN identifying these vessels as the Kaman-class. The 275-ton diesel-powered warships were well armed for their modest size, featuring a OTO Melara 76mm autocannon forward of the superstructure and four canisters, each containing a single RGM-84 Harpoon, amidships. The IIN had placed an order for 60 ASMs with McDonnell Douglas, but only a handful had been delivered prior to the Iranian Revolution in February 1979 that resulted in the US government halting all arms exports to the country.

The first nine Kaman-class vessels entered service between August 1977 and September 1979, but the remaining three were delayed until August 1981 due to Iran's failure to pay for them. By then, the IRIN had seen considerable combat with the fast attack craft during a series of fiercely fought engagements with Iraqi missile boats following the commencement of the Iran–Iraq War in September 1980.

The Kaman-class fast attack craft *Gardouneh* is a sister-ship to *Joshan*, sunk on April 18, 1988. Seen here in 2001, the vessel was part of the second batch of six La Combattante II-class warships ordered by the IIN in October 1974. *Gardouneh*'s four Harpoon canisters are still in place, despite them almost certainly being empty. It was the last Kaman-class vessel to keep the canisters, with the remaining nine fast attack craft being fitted with four Chinese-built C-802 ASMs in 1996–98. (US Navy)

According to Iranian sources, on the night of October 22–23, *Joshan* had become the first warship to fire a Harpoon in anger when it used a single missile to hit an Iraqi Osa-class vessel in the Northern Arabian Gulf. The Iraqi Navy struck back on November 29 when *Joshan*'s sister-ship *Peykan* was sunk by three (of six) "Styx" ASMs fired by three Osa-class fast missile craft.

Joshan remained in service until April 18, 1988, when it attempted to engage the US warships of SAG Charlie after they had shelled the Sirri-D GOSP. Having just returned from escorting a tanker convoy from Khark to Lavan island, the vessel was ordered into action by the IRIN commander of the 1st Naval District, Capt Amir Yegenah. Commanded by Lt Cdr Abbas Mallek, *Joshan* closed to within ten nautical miles of the cruiser *Wainwright* despite being warned by SAG Charlie not to do so.

At 1215 hrs, in a breach of the IRIN's strict rules of engagement (RoE) that prohibited vessels from firing first at US Navy warships, Mallek launched an RGM-84A Harpoon at *Wainwright*. This was defeated by chaff, heavy electronic countermeasures, and evasive maneuvers. *Joshan* was then hit by five Standard SSMs fired by *Wainwright* (a single SM-2MR) and the frigate *Simpson* (four SM-1MRs). At 1358 hrs, *Bagley* just missed the now-crippled warship with an RGM-84A. Despite having been struck multiple times, *Joshan* remained afloat until 1621 hrs, when it was sunk by shellfire from SAG Charlie.

USS *Bagley* (FF-1069)

No fewer than 46 Knox-class anti-submarine warfare (ASW) frigates (classified as destroyer escorts until 1975) were built for the US Navy between 1965–74, but USS *Bagley* (FF-1069) was the only one to fire a Harpoon in anger. It just missed *Joshan* with a single RGM-84A at approximately 1358 hrs on April 18, 1988.

The 18th Knox-class vessel to be completed, *Bagley* was commissioned at the Puget Sound Naval Shipyard at Bremerton, Washington, on May 6, 1972. Assigned to the Pacific Fleet, the 4,190-ton warship commenced its first Western Pacific (WestPac) deployment in September 1973.

On June 30, 1975, all the US Navy's destroyer escorts were redesignated as frigates, with DE-1069 duly becoming FF-1069. A month later, *Bagley* sailed from San Diego on its second WestPac for operations with Seventh Fleet – this cycle of six-month deployments would continue throughout the vessel's operational life. In the early 1980s, *Bagley*'s ASW-optimized ASROC launcher forward of the superstructure was modified to fire Harpoon ASMs as well – typically, only two such weapons were

Bagley is put through its paces during a high-speed run while undergoing sea trials from Puget Sound Naval Shipyard prior to its commissioning into US Navy service in May 1972. As part of the Knox-class, the frigate was primarily developed to perform the ASW role. However, in the early 1980s, its forward ASROC launcher (immediately ahead of the superstructure) was modified to also fire RGM-84s as well. (US Navy)

carried. The aft eight-cell Mk 25 Basic Point Defense Missile System for the Sea Sparrow SAM, installed when the vessel had been built, was also replaced at this time with a Phalanx Close in Weapons System (CIWS) armed with a six-barrel 20mm M61 Vulcan Gatling gun. These weapons complemented the frigate's single 5-in. DP Mk 42 gun in the bow and four torpedo tubes.

In January 1986 *Bagley* was assigned to the *Enterprise* battle group and embarked on an overseas deployment that saw it transit through the Suez Canal in April and operate in the Mediterranean in support of Sixth Fleet vessels patrolling along the 'Line of Death' in the wake of Operation *El Dorado Canyon*. By the time the frigate returned to San Diego in August, it had conducted operations in three of the US Navy's four active fleets.

Deploying once again with the *Enterprise* battle group in January 1988, *Bagley* headed for the Arabian Sea. Four days after the Oliver Hazard Perry-class frigate *Samuel B. Roberts* struck an Iranian mine on April 14, *Bagley*, *Wainwright,* and *Simpson* (which were all part of the *Enterprise* battle group) formed SAG Charlie and were ordered to destroy Iranian guns and military installations on the Sirri-D oil platform. At 1200 hrs, four hours after shelling the target, *Bagley*'s embarked SH-2 Seasprite helicopter spotted the Iranian fast attack craft *Joshan* closing on SAG Charlie. After the IRIN vessel fired a Harpoon at *Wainwright*, the cruiser and *Simpson* hit it with SSMs and *Bagley* just missed with an RGM-84A.

In the hours after this clash, a US Marine Corps AH-1T SeaCobra flying from *Wainwright* was lost, possibly to enemy antiaircraft fire. *Bagley* spent two days in a

fruitless search for the missing helicopter and its crew. The frigate remained on station in the Arabian Sea until mid-May, when it set course for home.

Bagley commenced its final WestPac in September 1989, during which it exercised off the Aleutian Islands, in the waters surrounding Okinawa and in the Sea of Japan. It eventually reached the Arabian Sea in mid-January 1990, before heading home in March. The frigate's final deployment took place 11 months later, when it spent eight weeks on drug interdiction duty off the west coast of Central America. *Bagley* was decommissioned in San Diego on 26 September 1991 and scrapped in 2000.

USS *Joseph Strauss* (DDG-16)

The last US Navy warship to fire a Harpoon missile in combat, USS *Joseph Strauss* (DDG-16) hit the Iranian Saam-class frigate *Sahand* with a single RGM-84 at 1540 hrs on April 18, 1988 during *Praying Mantis*.

Commissioned on April 20, 1963 as part of the 23-strong Charles F. Adams-class of guided-missile destroyers, it was the oldest US Navy vessel to employ the Harpoon operationally. The 4,526-ton *Joseph Strauss* joined the Pacific Fleet as the flagship of Destroyer Squadron 3, the ship departing Long Beach for its new home at Yokosuka, Japan, in June 1964. Two months later, it was assigned to the USS *Constellation* (CVA-64) battle group following the Tonkin Gulf Incident that eventually led to US forces being committed to the conflict in Vietnam. The destroyer would subsequently see much action as a search-and-rescue/AAW picket ship in the Gulf of Tonkin, and aircraft under the control of its Combat Information Center (CIC) were responsible for destroying three North Vietnamese MiG-17s in June 1965 – these were the first enemy aircraft downed by US forces since 1953.

On October 28, 1965, *Joseph Strauss* expended 217 5-in. shells from its two Mk 42 guns in support of the Army of the Republic of Vietnam and the US Marine Corps during a search-and-destroy operation against the Viet Cong. By doing so, the vessel became the first US Navy guided-missile destroyer to engage the enemy with gunfire. Changing home port to Pearl Harbor, Hawaii, in July 1966 following a second Gulf of Tonkin deployment, the destroyer subsequently completed multiple operational cruises in support of TF 77 into the mid-1970s.

As part of a modest upgrade to all Charles F. Adams-class destroyers instigated in the late 1970s, *Joseph Strauss* was made Harpoon-capable. The RGM-84 was to be fired from the ship's single-arm Mk 13 Mod 0 guided-missile launching system (GMLS),

The Charles F. Adams-class destroyer *Joseph Strauss* was the second, and last, US Navy warship to attack an IRIN vessel with a Harpoon missile during *Praying Mantis*. It fired an RGM-84 from the single-arm Mk 13 Mod 0 GMLS (seen here near the stern of the ship) at *Sahand* at almost the same time as an A-6E from VA-95 also targeted the Iranian frigate with a Harpoon. (US Navy)

which had previously only been capable of firing Tartar/Standard-MR SAMs – the first 13 vessels in the class had a single twin-arm Mk 11 Mod 0 launcher. *Joseph Strauss*'s ASW weaponry in the form of an ASROC Mk 16 launcher and six torpedo tubes remained unaltered throughout its service.

Kept busy on WestPac deployments from San Diego during the 1980s, *Joseph Strauss* spent more and more time in the Persian Gulf supporting carrier battle groups as tensions in the region progressively rose due to the Iran–Iraq War. Assigned to the *Enterprise* battle group, the destroyer again headed west in January 1988, bound for the Arabian Sea. Following two months of little action, the *Samuel B. Roberts* struck an Iranian mine on April 14 and the *Enterprise* battle group prepared for action.

Four days later, the IRIN attempted to challenge US Navy vessels in the region after they had targeted two Iranian oil platforms suspected of supporting the mining of international waters and directing attacks by warships on merchant ships. After a Harpoon was fired at the cruiser *Wainwright* (part of SAG Charlie) at 1240 hrs, the US warships responded with overwhelming force. Two hours later, the Saam-class frigate *Sahand* departed Bandar Abbas with orders to engage the *Enterprise* battle group. SAG Delta, consisting of *O'Brien*, *Jack Williams*, and *Joseph Strauss*, was ordered to search for the vessel. At 1530 hrs *Sahand* was attacked by a lone Intruder from VA-95, and ten minutes later a second A-6E and six A-7Es also targeted the frigate.

Of the three vessels that comprised SAG Delta, *Joseph Strauss* was the closest to *Sahand*. It was cleared to engage the warship just as the seven aircraft from *Enterprise* approached, and its commanding officer, Cdr Samuel Anderson, gave the order to fire a single RGM-84 at 1540 hrs. The weapon hit *Sahand*, as did numerous smart and dumb bombs and a second air-launched AGM-84D. The frigate sank two hours later.

Joseph Strauss completed its final WestPac in July 1988, and the vessel was decommissioned on February 1, 1990. It was one of four former US Navy Charles F. Adams-class destroyers transferred to the Greek Navy, being christened *Formion* (D220) on October 1, 1992. Eventually stricken in January 1995, the warship was sold for scrapping in February 2004.

Waheed (526)

The fourth of ten Beir Grassa-class fast attack craft built by CMN for the Libyan Navy, *Waheed* was struck by two Harpoons and several Rockeye cluster bombs expended by A-6Es from VA-34 and VA-85 during Operation *Prairie Fire*.

Similar to the Iranian Kaman-class, the Beir Grassa-class vessels were modified La Combattante II-class warships of 265 tons armed with a 76mm/62 OTO Melara compact autocannon forward of the superstructure, four Otomat 1 ASMs in canisters amidships, and two 40mm/Breda Bofors in a single mounting aft. They entered service between June 1979 and January 1982, with *Waheed* being commissioned on September 30, 1980. The missile attack craft packed a considerable punch, with their four turbojet-powered Otomat 1 ASMs (each one of which had a 460lb warhead) having a practical range of 37 miles.

Shortly after carrier-based aircraft attempted to attack SA-5 sites during the early evening of March 24, 1986, thus signaling the start of *Prairie Fire*, *Waheed* was ordered to deploy from its base at Misratah and engage US Navy vessels in the Gulf of Sidra.

USS *JOSEPH STRAUSS* (DDG-16)

A veteran of combat in the Vietnam War, the Charles F. Adams-class guided-missile destroyer USS *Joseph Strauss* (DDG-16) was the only US Navy warship to ever achieve a confirmed hit with a Harpoon on an enemy vessel. It struck the IRIN frigate *Sahand* with a single RGM-84 at 1540 hrs on April 18, 1988 during Operation *Praying Mantis*. The weapon was fired from the ship's single-arm Mk 13 Mod 0 GMLS aft of the No. 2 5-in. Mk 42 turret.

Heading northeast at a speed of 24 knots, the warship was quickly detected by an E-2C and the cruiser *Ticonderoga*. Two Surface Combat Air Patrol (SUCAP) sections of A-6Es were vectored towards *Waheed* by the Hawkeye, the Intruders from VA-34 being armed with AGM-84As and those from VA-85 carrying Mk 20 Rockeye CBUs.

Having located his target on radar, the lead A-6 pilot in a two-aircraft section from VA-34 was given permission to fire a Harpoon from a range of 16 miles at 1926 hrs. Several minutes later, his wingman, who achieved the correct firing position ahead of his section lead, fired his AGM-84 first. The missile skimmed the surface of the water at more than 550mph, before "popping up" and diving into *Waheed*'s superstructure. It exploded seconds later, devastating the warship. The section lead then also achieved a hit with his Harpoon, after which two Intruders from VA-85 finished the vessel off with multiple CBUs. Seventeen survivors from *Waheed*'s 40-strong crew were rescued by a Spanish tanker the following day.

Beir Gzir, seen here on a visit to Malta in the early 1980s, was a sister-ship of *Waheed*, sunk during *Prairie Fire*. The French-built La Combattante II-class fast attack craft were powerfully armed despite their modest displacement of just 265 tons, featuring a 76mm/62 OTO Melara compact autocannon forward of the superstructure, four Otomat Mk 1 ASMs in canisters amidships and two 40mm/Breda Bofors in a single mounting aft. (Public Domain)

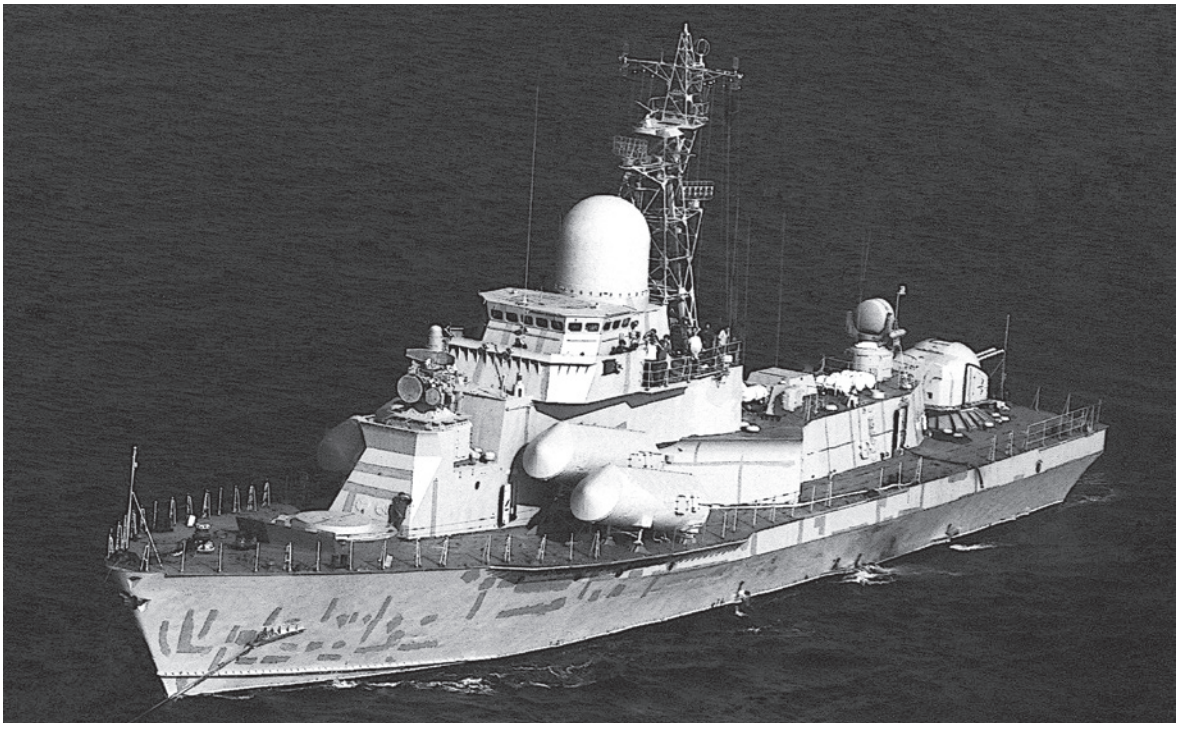
Ain Zaquit (419)

The second ship sunk during Operation *Prairie Fire* was the Nanuchka II-class corvette *Ain Zaquit*, which was attacked by Intruders from both VA-55 and VA-85 at 0600 hrs on March 25, 1986. The previous night, its sister-ship *Ain Mara* had been badly damaged by Rockeye CBUs dropped by an A-6E also from VA-85.

A total of 47 Nanuchka I-IV-class warships were constructed in the Soviet Union between 1967–91, with the 671-ton vessels being designed around the P-120 Malakhit ASM – examples built for export featured four P-15 Termits (SS-N-2C Styx), in individual canisters flanking the superstructure, instead. They were also fitted with a single 4K33 Osa-M (SA-N-4 "Gecko") SAM launcher forward and two 57mm AK-727 DP cannon in a single turret aft.

WAHEED

Waheed was the fourth of ten Beir Grassa-class fast attack craft supplied to the Libyan Navy. Although only displacing 265 tons when fully loaded, the French-built vessel was well armed with a 76mm/62 OTO Melara compact autocannon forward of the superstructure, four Otomat Mk 1 ASMs in canisters amidships, and two 40mm/Breda Bofors in a single mounting aft.



The Libyan Navy was supplied with four Nanuchka II-class corvettes in 1982–85 by the USSR, these vessels having all briefly served with the Soviet Navy. The exact identity of this particular warship remains a mystery, the Libyan corvette having been photographed in the Gulf of Sidra by a US Navy P-3 Orion just prior to *Prairie Fire*. (US Navy)

Built at the Vympel Shipyard in the USSR as *MRK-15* in 1983–84, *Ain Zaquit* was the last of four Nanuchka II-class corvettes transferred from the Soviet Navy to Libya in 1982–85. It had seen less than a year of service with the Libyan Navy when sunk by Intruders from *Saratoga* and *Coral Sea*.

Sahand (74)

In August 1966, the IIN placed an order with British ship builder Vosper Thornycroft for four Mk V-class destroyer escorts. Each vessel cost £6.5 million, and they were armed with five Sea Killer Mk 2 ASMs in individual canisters, a single launcher for Seacat SAMs, a triple-barrelled Mk 10 Limbo anti-submarine mortar, a Vickers Mk 8 Mod 0 114mm gun forward, and twin 35mm Oerlikon cannon in a single turret aft. Fast warships thanks to their advanced combined diesel or gas propulsion, the Mk Vs could accelerate to 40 knots thanks to twin Rolls-Royce Olympus TM3A gas turbines, or cruise more economically with their twin Paxman Ventura diesels.

Sahand was the last of the four vessels built for the IIN, being launched on July 30, 1969 and commissioned as IIS *Faramarz* (DE18) in February 1972. Along with its sister-ships, *Faramarz* initially saw action in 1974 when it shelled rebel positions in Oman whilst supporting a counterinsurgency campaign by Iranian Marines involved in the long-running Dhofar Rebellion. In the wake of the Iranian Revolution in February 1979 and the establishment of the IRIN, all four of the Mk V-class vessels were renamed. Now known as a Saam-class frigate (the first ship in the class was re-christened *Saam*, having previously been *Alvand*), *Faramarz* became *Sahand* (74).

The Tanker War phase of the long-running Iran–Iraq conflict commenced in March 1984, with attacks by missile-armed Iraqi aircraft on vessels predominantly

AIN ZAQUIT

The 671-ton Nanuchka II-class corvette *Ain Zaquit* was the second Libyan naval vessel to be sunk by during Operation *Prairie Fire*, having initially been hit by Rockeye CBUs and then sunk by a single AGM-84 fired by an A-6E from VA-85. Its sister-ship *Ain Mara* had been badly damaged by CBUs hours earlier.

The Saam-class frigate *Sahand* exercises in the Strait of Hormuz, the vessel's Vickers Mk 8 Mod 0 114mm gun being trained on a target to port. Both this weapon and the twin 35mm Oerlikon cannon in a single turret aft were frequently used to shell unarmed merchantmen in the Persian Gulf during the long-running Tanker War. (Public Domain)

sailing in Iranian waters. Iran soon retaliated, and once it had exhausted its limited supply of Western-built ASMs, the task of attacking vessels fell to *Sahand* and its sister-ship *Sabalan*. They would frequently target merchant vessels in the Persian Gulf and the Strait of Hormuz – both areas very close to their base at Bandar Abbas – with gun fire from their twin turrets. In an effort to halt these tit-for-tat actions, UN Security Council Resolution 598 saw the commencement of Operation *Earnest Will* on July 24, 1987, after which US Navy warships would protect Kuwaiti-owned but US-flagged supertankers from Iranian attacks through to September 26, 1988.

The attacks, and the planting of mines by Iranian vessels, continued throughout *Earnest Will*, eventually bringing the US Navy into direct conflict with IRIN warships on April 18, 1988 – just four days after the frigate *Samuel B. Roberts* had hit a mine. Once it was determined that Iran was responsible for the mining, the US government decided that retaliatory action was required. Three Iranian oil platforms were identified as having supported the mining operation, and so US Navy warships split into SAGs were cleared to destroy them in Operation *Praying Mantis*. It was also hoped that both *Sabalan* and *Sahand* would respond to the destruction of the oil and gas platforms, thus allowing them to be attacked too.

The IRIN initially sent smaller vessels out to engage the SAGs, with Boghammer-class speedboats and the Kaman-class fast attack craft *Joshan* being attacked by both carrier-based aircraft and warships. Despite this, orders directly from Tehran sent *Sahand*, skippered by Cdr Shahrokhfar, from Bandar Abbas shortly before 1500 hrs in search of US Navy vessels to attack. The frigate headed south, in the direction of SAG Delta, and it was soon detected by *Jack Williams*. The crew of the Oliver Hazard

Perry-class frigate warned their counterparts on board *Sahand* (in both Farsi and English) to leave the area or face being take under fire.

Minutes later, an Intruder from VA-95 flew overhead, and at least two SA-7 "Grail" Man-Portable Air-Defense Systems (MANPADS) were fired at the aircraft from *Sahand*. There were also reports that the Intruder was targeted by the frigate's guns. The Intruder responded with a single AGM-84D, which hit the warship amidships. Even prior to being struck by the ASM, *Sahand* was struggling with an inoperable fire control radar and unserviceable missile launchers due to poor maintenance and a shortage of key parts following the 1979 revolution. A second A-6E and six A-7Es from *Enterprise* then hit *Sahand* with another Harpoon and both smart and dumb bombs. Finally, an RGM-84 fired by *Joseph Strauss* also struck the frigate.

With its superstructure wrecked, hull shattered and fire engulfing the warship from stem to stern, *Sahand* was abandoned by surviving crewmen in whatever intact life boats could be launched. The conflagration eventually reached the main ammunition magazines two hours after the attack, resulting in several large explosions that sank the frigate.

A-6E Intruder

The only aircraft to fire a Harpoon in anger during 1986–88 was the Grumman A-6 Intruder, which, by then, had already completed more than 20 years of frontline service with the US Navy and US Marine Corps. A dedicated attack aircraft that equipped no fewer than 19 first line units in the mid-1980s, the E-model Intruder featured numerous upgrades that had turned a grizzled veteran of the Vietnam War into a platform for the delivery of precision weapons.

The AGM-84 Harpoon was amongst the new wave of missiles and smart bombs available to the Intruder for *Prairie Fire* and *Praying Mantis*. In the following extract from *Osprey Combat Aircraft 121 – A-6 Intruder Units 1974–*96, Naval Aviation historian Rick Morgan describes the reason why the Harpoon ASM was chosen for the aircraft:

> During the Vietnam War, the Intruder had made a name for itself with the amount of bomb tonnage it could employ. Among other qualities, the aircraft's ability to carry 28 500lb bombs was widely advertised as "being greater than a B-17." The type was also central to "Alpha Strike" tactics that emphasized large numbers of aircraft delivering a lot of unguided (ballistic, or "dumb") weapons on a single target. By the end of the Vietnam conflict, the A-6 was at the forefront of new "precision" (or "smart") weapons delivery with Laser Guided Bombs (LGBs).
>
> While carrier air wings would continue to practice "mass gaggle" Alpha Strikes through to the late 1980s, the arrival of new precision weapons signaled a sea change from "many bombs – or aircraft – on one target" to what would eventually become "one bomb/one target." The change did not come easy, but advances like the Target Recognition Attack Multi-Sensor [TRAM] pod fitted under the nose of the A-6E quickly made LGBs the preferred weapon for many target sets.
>
> It did not stop at the water's edge either, as the renewed post-Vietnam emphasis on "war-at-sea" led to the not-so-secret realization that the US Navy really did not have an appropriate set of weapons that could deal with improvements in Soviet Navy air defense.

An A-6E of test and evaluation squadron VX-5 undertakes a missile carriage proving flight from Naval Weapons Center China Lake, California, in the late 1970s. No carrier-based fleet unit ever sortied an Intruder with four AGM-84s, as the combined weight of these weapons would make the aircraft too heavy to land back aboard the ship if the missiles were not expended during the course of the mission. (US Navy)

New Soviet warship designs featured SAM systems that could reach out well beyond 20 miles, with much greater ranges promised soon. Even with EA-6B Prowler electronic warfare (EW) jamming support, the prospect of Intruders and Corsair IIs arriving overhead to rain "dumb" bombs on these ships in World War II fashion was highly unlikely. A new stand-off, ship-killing weapon had to be developed and deployed.

The criticality of acquiring an anti-ship "cruise missile" was demonstrated on October 21, 1967 with the destruction of the Israeli destroyer *Eilat* by Egyptian "Styx" missiles fired from Komar-class patrol boats. By 1970, the service had engaged McDonnell Douglas to develop the Harpoon, a sea-skimming, active-radar homing weapon that would be deployed in air (AGM-84), surface (RGM-84), and sub-surface (UGM-84) launched versions. The Intruder would introduce the new subsonic missile to the fleet in 1977, and it would remain an important weapon over the years. Meanwhile, the AGM-53 Condor, a larger, faster, and more capable missile (as well as more complex and expensive) was subsequently canceled in favor of the Harpoon.

The desire to also have a cheaper precision weapon than the AGM-84 available for the anti-ship mission led to the rapid development of the AGM-123 Skipper II at China Lake. It featured a Mk 83 1,000lb LGB mated to a rocket motor from the AGM-45 Shrike anti-radiation missile. The rocket gave it enough stand-off range to engage small boats and ships, while also providing more target selectivity than Harpoon – the laser guidance allowed the A-6 bombardier/navigator [B/N] to select a specific point of impact, whereas the Harpoon's radar guidance homed in on whatever return it saw. The Skipper entered service in 1985, and would be used in several future conflicts (including *Praying Mantis*).

THE STRATEGIC SITUATION

LIBYA

If the 1970s had started calmly in the Mediterranean for US forces, this rapidly changed as the decade progressed due to reoccurring, and escalating, stages of warfare between Israel and its Arab neighbors, as well as the emergence of a number of non-state terrorist groups. In Libya, Col Muammar Gaddafi had seized control via a coup in September 1969, and over time he established a revolutionary government supported by the Soviet Union and hostile to the west, and the United States and Israel in particular. His actions would lead to several years of conflict with neighbors and a handful of significant clashes with US forces, one of which involved the Harpoon missile.

In 1974 Gaddafi declared that the Gulf of Sidra, the portion of the Mediterranean south of the 32° 30' North latitude, was sovereign Libyan water and, therefore, off-limits to all other shipping. Furthermore, he promised a "military response" should a foreign power ignore the so-called "Line of Death" (as it was

This commemorative stamp, released by the Libyan government on the 13th anniversary of the September 1969 "revolution" that had seen Col Muammar Gaddafi seize control of the country, features elements from all three branches of the nation's armed forces. The MiG-25 interceptors and a Beir Grassa-class fast attack craft would be involved in the clash with the US Navy in March 1986. (Public Domain)

The delivery of second-generation SAMs to Libya in the form of the long-range SA-5 "Gammon" in 1985–86 significantly boosted its already impressive IADS. The firing of a handful of these weapons at US Navy aircraft in March 1986 precipitated the start of *Prairie Fire*. (Public Domain)

later dubbed by US Navy sailors in the wake of Gaddafi's frequently dire warnings for those that crossed it) that marked these waters as Libyan territory. The US government refused to accept the claim, and the US Navy's Sixth Fleet, based in the Mediterranean, became the obvious tool to dispute the issue. The US Navy responded with what was described as FONOPs, where its warships, supported by land- and carrier-based aircraft, would routinely operate in the disputed waters. Libya's answer was initially muted, and it would take several years before things really heated up.

From the late 1970s, Libya had used its oil revenues to commence the creation of an Integrated Air Defense System (IADS) with the intention of covering much of the nation's Mediterranean coastline between Tripoli and Tobruk, as well as major bases in the center and south of the country. Substantial quantities of radar equipment, SAMs, and communication systems were acquired from 1977. Soviet reports stated that sufficient hardware was purchased for 86 battalions equipped with 276 launchers for SA-2 "Guideline" and SA-3 "Goa" SAMs. Mobile SAMs were also purchased, with French-made Crotale and Soviet SA-6 "Gainful" and SA-8 "Gecko" systems being bought. Furthermore, all units of the Libyan Arab Army were protected by 23mm ZSU-23-4 Shilka AAA batteries and SA-7 "Grail" MANPADS.

In 1985–86, Libya's already impressive IADS (which relied heavily on Soviet and other foreign advisers for its effective operation) received a considerable boost when long-range SA-5 "Gammon" SAMs were delivered. A second-generation weapon, the SA-5 had been developed to complement the tried and tested SA-2.

Guiding the various SAMs were no fewer than eight types of Soviet early-warning radar and three models of height-finding radar. These systems provided coverage out to a range of about 350km from Tripoli and Benghazi, and at a distance of 50km, they could detect targets down to an altitude of 50–100m.

The LAAF was also equipped with an impressive mix of Soviet- and French-made combat aircraft, including the MiG-23 "Flogger" and MiG-25 "Foxbat," Su-22 "Fitter," and Mirage F1. Despite possessing some of the most advanced fighters and bombers in the region, the LAAF lacked ASMs, however.

This was not the case with the Libyan Navy, which operated from bases at Tripoli, Al-Khums, Marsa el Brega, Benghazi, Ras al-Helal, Derna, and Tobruk. Immediately prior to Operation *Prairie Fire*, the US Navy's Office of Naval Intelligence estimated that Libya possessed 31 missile-armed ships and six Soviet-built Foxtrot-class

submarines. Its principal warships were a single British-built Vosper Mk 7 frigate (similar to the Iranian Saam-class) which was armed with four Otomat 1 ASMs, four Italian-built Assad-class corvettes that also had Otomat 1s (six in total), and four Soviet-built Nanuchka II-class corvettes equipped with four SS-N-2 "Styx" ASMs. The Libyan Navy also possessed ten French-built Beir Grassa-class fast attack craft that each carried four Otomat 1s and 12 Soviet Osa II-class missile boats armed with four SS-N-2 "Styx" per vessel.

The first armed clash between the US Navy and the LAAF occurred on August 19, 1981 when F-14As flying from USS *Nimitz* (CVN-68) downed two Su-22 "Fitters" that had attempted to engage them over the Gulf of Sidra. Libya's apparent response to what it viewed as US aggression was to support a series of terrorist attacks in Lebanon and Europe by surrogate groups.

Just five weeks after being promoted to Commander, Sixth Fleet, career submariner Vice Admiral Frank Kelso (seen here in December 1986 after becoming Commander-in-Chief, US Atlantic Fleet – he was eventually the 24th Chief of Naval Operations) was instructed by the US government to undertake more FONOPs off the coast of Libya in the form of *Attain Document III*. Gaddafi's response to this saw Kelso's contingency operation, *Prairie Fire*, triggered following approval by President Reagan. (US Navy)

By January 1986, President Ronald Reagan had declared Libya to be an "unusual and extraordinary" threat to the United States that had to be dealt with. At that time, Sixth Fleet consisted of two carrier battle groups – *Saratoga* (CVW-17, which included A-6E-equipped VA-85), having just returned from the Indian Ocean, and *Coral Sea* (CVW-13, which included A-6E-equipped VA-55), which had been on station for several weeks. In Norfolk, Virginia, *America* (CVW-1, which included A-6E-equipped VA-34) was preparing for a March departure to join them.

Operation *Attain Document I*, a large FONOP, began on January 15. Libya placed its forces on "full alert" and declared that America was "practicing state terrorism against a small, peaceful country." Fighter aircraft from both sides jousted over the Gulf of Sidra as the LAAF attempted to counter "incursions" by US Navy Tomcats, but there were no shots exchanged. A month later, on February 12, Sixth Fleet returned for *Attain Document II*, with several of its vessels crossing the "Line of Death."

On March 14, the US government authorized Commander, Sixth Fleet, Vice Admiral Frank Kelso, to prepare for more operations off the coast of Libya. These took the form of *Attain Document III*, which commenced at noon on March 24 when the SAG comprising *USS Ticonderoga* (CG-47), *USS Scott* (DDG-995), and *USS Caron* (DD-970) crossed the "Line of Death." By then, the *America* battle group had reached the area and joined *Saratoga* and *Coral Sea* in Task Force Zulu, consisting of 26 warships and more than 250 aircraft. A number of vessels, supported by carrier-based combat aircraft, were now operating well into the Gulf of Sidra in what was clearly viewed as a provocative act by Libya.

At 1352 hrs, two SA-5s from the battery at Sirte fired at F-14s covering the SAG. Both SAMs missed, with their launching, according to Soviet sources, being ordered by Gaddafi himself. This hostile action gave the US Navy an opportunity to strike back – Kelso had been increasingly concerned about a possible attack by Libyan forces on Sixth Fleet vessels, and he had developed a contingency operation, codenamed *Prairie Fire* and approved by President Reagan, in response to any such action. Whilst preparing to target the SA-5 site that fired the SAMs, Kelso received the following teletype message from

An F-14A of VF-33 is launched from one of *America*'s two bow catapults at the start of an *Attain Document III* mission in support of US Navy warships sailing south of the "Line of Death" in March 1986. The aircraft is armed with live AIM-7M and AIM-9L air-to-air missiles. Behind the Tomcat, an F-14A from sister-squadron VF-102 awaits its turn to launch from the carrier. (US Navy)

Col Salleh Abdullah Salleh, Commander-in-Chief of the LAAF:

> Unless the aggressive acts are stopped against Jamahiriyya [Libya], we are bound to destroy the CV carriers. In doing that [we] will have the political and military support of the world states. Maintain peace and you will leave in peace.

Shortly thereafter, Kelso ordered the commencement of Operation *Prairie Fire*, with the Sirte SA-5 battery being slated for destruction. At 1830 hrs two A-7Es armed with AGM-88 High-speed Anti-Radiation Missiles launched to attack the SAM site, and they were targeted by another SA-5 shortly thereafter. With the element of surprise lost, the attack was immediately called off. Nevertheless, an SA-2 and another SA-5 were launched, and less than an hour later the fast attack craft *Waheed* of the Libyan Navy was detected by an E-2C and *Ticonderoga* approaching the SAG.

A SUCAP section of two A-6Es was vectored towards *Waheed* by the Hawkeye, the Intruders from VA-34 being armed with AGM-84As and Mk 20 Rockeye CBUs. Having located his target on radar, the lead A-6 pilot radioed *Saratoga* to verify permission to fire an AGM-84A at *Waheed*. Moments later, he received the reply, "the admiral [Rear Admiral David E. Jeremiah, commander of the *Saratoga* battle group] says 'Smoke 'em'." Operation *Prairie Fire* was about to commence in earnest.

IRAN

While Sixth Fleet stood off Libya, other US Navy carriers continued making long deployments to the Indian Ocean to monitor Iran. Practically every Seventh Fleet carrier made a swing through the Indian Ocean between 1980 and 1990, with Atlantic Fleet ships reporting as well, frequently after a transit around the southern end of Africa. These cruises were typically long and monotonous for crews, with few liberty ports to break things up. Logistical support remained a challenge as things like fresh produce and milk would routinely run out while underway. Meanwhile, the US Navy continued to develop Diego Garcia as a forward support base and work with friendly local governments – generally those threatened by Iran – for improved facility access.

Tensions had been on an edge in the Persian Gulf since September 22, 1980, when Iraq invaded Iran to start a conflict that ran for one month short of eight years, saw limited territorial gains made by either side, and resulted in the deaths of possibly as many as 900,000 military personnel and more than 100,000 civilians. Warfare

between the IRIN and the Iraqi Navy was initially limited in its scope, with the commander of the latter force, Lt Gen Abid Mohammed al-Kabi, telling the Institute for Defense Analysis team:

> At the beginning of the war, high command considered the [Iraqi] navy to be the weakest link in the armed forces. Therefore, most early missions assigned to the navy were defensive in nature. We were most afraid of their (Iranian) La Combattante IIA-class missile boats armed with the American Harpoon missile. The range of the Harpoon was approximately 90km, whereas the range of our Russian-made P-15 (SS-N-2 Styx) missile was approximately 40km. Our missiles were inferior in range and technology, but the Soviet warhead was larger than those on the Harpoons.

Naval warfare in the Iran–Iraq War escalated dramatically from March 1984, when missile-armed Iraqi aircraft and helicopters commenced attacks on the Iranian oil terminal and tankers at Kharg Island, 16 miles off the coast of Iran. The Iraqis hoped that the Iranians would shut the Strait of Hormuz to all vessels in an attempt to stop losses to missile attacks, thus drawing US forces in the region into the conflict. The Reagan administration had threated to intervene should the Strait be closed. Iran knew this, and restricted its retaliatory attacks by aircraft and warships to Iraqi shipping.

The resulting Tanker War was the longest running, most lethal anti-ship campaign of the modern era. The US Navy eventually became involved from July 1987 in Operation *Earnest Will*, with its warships protecting Kuwaiti-owned but US-flagged super tankers from Iranian attacks through to September 26, 1988, four days after a ceasefire brought the Iran–Iraq conflict to an end.

Prior to the 1979 revolution in Iran, the nation's armed forces had been supplied with Western, primarily US, weapons. The Imperial Iranian Air Force and IIN were

USS *Hawes* (FFG-53), USS *William H. Standley* (CG-32), and USS *Guadalcanal* (LPH-7) escort the tanker *Gas King* in the Persian Gulf on October 21, 1987 during *Earnest Will*. That month alone, 17 merchant ships suffered varying degrees of damage after being struck by ASMs and gunfire from Iraqi aircraft and Iranian naval vessels. (US Navy)

the most powerful in the Persian Gulf region, with the former receiving F-14As, F-4D/Es, and F-5E/Fs fighters and P-3F patrol aircraft. The IIN's small but potent fleet of warships (principally its four Alvand-class frigates and nine Joshan-class fast attack craft) were also on the cusp of receiving RGM-84A Harpoons, 60 of which had been ordered. Only a small number had arrived by the time of the revolution, however, and no more would be delivered. When the IIN became the IRIN in February 1979, it inherited these vessels.

Commodore Mohammad-Hossein Malekzadegan was made commander-in-chief in June 1985. In an April 30, 1987 television interview, Malekzadegan stated:

> With 80 vessels equipped with advanced systems, the navy has attained the readiness to safeguard the security of our Islamic homeland waters, its 16 islands and the country's vital resources. In addition to these vessels, our navy possesses the most complex coastal missile defense system. These are the most effective missiles, and are installed in various places.

The bulk of the vessels Malazadegan was referring to were based at Khorramshahr, Kharg Island, Bushehr, and Bandar Abbas.

From 1983, the IRGCN fielded an irregular naval force of more than 1,000 commandos operating 50 high-speed Boghammer speed boats purchased from Sweden. Some 42ft in length and manned by crews armed with machine guns, rockets, recoilless rifles, and other weapons, the Boghammers (and a similar number of glass fiber-hulled speedboats sourced from other companies or built in Iran) attacked tankers, merchantmen, and tugs, as well as threatening naval vessels using swarm tactics. In an April 28, 1987 television interview, the commander of the IRGCN unit at Bandar Abbas stated:

> Our unit has radar coverage of the whole Persian Gulf and Sea of Oman. The IRGCN and IRIN are not separate from each other and they work as two powerful arms of the Islamic Republic. They have at their disposal small fiber-glass vessels and the most powerful coast-to-sea missile systems in the Persian Gulf, and these missiles were installed for defensive purposes and will be used whenever necessary.

The anti-ship cruise missiles (ASCMs) referred to by both the IRGCN commander and Malazadegan were HY-1As acquired from China in the mid-1980s. These were license-built CSSC-2 Silkworm ASCMs based on the Soviet SS-N-2 "Styx." Longer-ranged HY-2 (CSSC-3 Seersucker) ASCMs were procured as well. Iraq also bought both weapons in considerable quantities. In 1986, US satellite imagery revealed evidence that Iran and Iraq were building launch sites for these coastal defense weapons. In 1987, Iran started firing ASCMs from the Al-Faw peninsula at ships and Kuwait's Sea Island offshore oil terminal.

Given the generic name of "Silkworm" by the press at the time, the Chinese-built ASCM had a warhead twice the size of the Harpoon's. A hit by one Silkworm could seriously damage a cargo ship or tanker, and sink most military vessels. On October 15, 1987, a Silkworm hit the tanker *Sungari*, setting it on fire, and the following day another ASCM damaged the US-flagged *Sea Isle City* tanker off Kuwait. In response, the US Navy was cleared to undertake Operation *Nimble Archer* on October 19, 1987,

Both Iran and Iraq fielded Chinese-built HY-1A ASCMs during the latter stages of the Tanker War, these being license-built CSSC-2 Silkworm missiles based on the Soviet P-15 Termit (SS-N-2 "Styx"). The weapon weighed more than two tonnes, compared to the 600–800kg of comparable Western ASMs. (Public Domain)

with four destroyers shelling two GOSPs in the Rashadat oil field. US Special Forces boarded one of the now abandoned platforms and seized documentation, then planted explosives to destroy it. The platforms had been targeted because it was believed that they were being used by the Iranians as command-and-control posts to track shipping movements and relay messages to IRGCN and IRIN vessels.

Lloyds of London reported 641 attacks on tankers and merchantmen during the Iran–Iraq War, with 286 of them involving ASMs. Nearly 200 ships were believed to have been hit by the weapons, which caused significant damage, and about 80 were lost. Iraq employed hundreds of Exocets fired from helicopters and fighters as their primary ASM weapon. When Iran exhausted its modest supply of Harpoon, Maverick and Sea Killer ASMs, it shifted to targeting ships with gun fire from naval vessels, Boghammer strikes, land-launched Silkworm missile attacks and, finally, mines.

It was an Iranian-made M.08 mine that gave the US government cause to declare a day-long war-at-sea, codenamed Operation *Praying Mantis*, against the IRGCN and

Having been holed by an Iranian M.08 mine on April 14, 1988, *Samuel B. Roberts* was returned to BIW's Portland, Maine, shipyard aboard the Dutch-owned semi-submersible heavy lift ship *Mighty Servant 2*. It took six months to repair the warship at a cost of $89.5 million. (US Navy)

IRIN on April 18, 1988. Four days earlier, at 1700 hrs, the US Navy frigate *Samuel B. Roberts* was underway in the Persian Gulf 60 nautical miles east of Bahrain. The warship was returning to Kuwait following the successful escort of a convoy as part of *Earnest Will* when the ship's lookouts spotted several mines. *Samuel B. Roberts*' commanding officer, Cdr Paul X. Rinn, immediately ordered the frigate to stop, and then reverse astern down its wake.

The vessel also launched its SH-60B helicopter to help locate additional mines and mark them with buoys and flares. Three more were found floating half-a-mile from the warship, and they were avoided, but a fourth made contact with the frigate. The M.08's 330lbs of TNT immediately detonated, blowing a 25ft hole in the port side of the hull that broke the keel, moved the vessel's two turbine engines off their mounts and flooded the main engine room. Despite being badly damaged, and with ten sailors wounded, the ship's crew managed to save the frigate.

US Navy divers subsequently recovered at least three unexploded mines, and their serial numbers matched weapons seized seven months earlier on board the Iranian vessel *Iran Ajr* when it had been captured during Operation *Prime Chance* (the covert element of *Earnest Will*) by SEALs whilst laying M.08s. The US government immediately commenced planning an appropriate "measured response" in the form of Operation *Praying Mantis*. This would prove to be the largest surface warfare naval battle since World War II.

THE COMBATANTS

US NAVY

Instructors at the US Navy's Surface Warfare Officers School Command at Naval Station Newport, Rhode Island, provided the following insight into Harpoon operations and planning as taught by them at the center since the 1970s:

General sequence of events:

- Surface Ships:

The ship's Tactical Action Officer (TAO) orders the Surface Warfare Coordinator to begin building a Harpoon engagement plan. The Harpoon Engagement Planner watch stander then begins building the Harpoon plan, which will be validated and approved by the TAO prior to launch.

- Aircraft:

The Naval Flight Officer (NFO) will select the surface contact to be engaged and build the Harpoon engagement plan. The aircraft will then maneuver to attain the launch acceptability region in a given time, altitude, and range prior to launch.

The Harpoon missile is propelled to cruising velocity by a solid-propellant rocket booster and then maintained at cruising velocity by the missile's turbojet sustainer. Significant features of the Harpoon missile include:

- Variable low-altitude flight path
- Fire-and-forget operation

- Over-the-horizon range
- Active radar missile seeker
- Counter-countermeasures
- All weather
- Selectable attack mode
- Contact-detonated, high-explosive, blast-type warhead

In normal mode, up to four missiles can be launched in a salvo from a single launcher (on a ship). The salvos can be planned for launch in the following methods:

- Ripple fire mode (fired sequentially)
- Simultaneous time on target (selected if the target range and bearing data are known. Designed to ensure all missiles will reach the target simultaneously)
- Designated Time on Target (a specific time is entered at the Weapon Control Indicator Panel (WCIP) for the missile arrival time on target)

During planning, the Harpoon Weapon System (HWS) operator creates and validates missile plans based on data inputs and stored program data. The following are major factors in creating and validating a firing plan.

- Own-ship and third-party safety constraints
- Own-ship parameters (course, speed, roll, pitch, launcher type)
- Target data (range, bearing, sensor type, sensor source, time of report, etc.)
- Background shipping and third-party positions
- Missile type
- Operating mode
- Background objects that include ships, shoreline, obstructions
- Environmental data (wind, temperature, rain)

For more than 60 years, the Surface Warfare Officers School Command at Naval Station Newport, Rhode Island, has been a "Center of Excellence" when it comes to training personnel charged with effectively employing US Navy warships in combat. Harpoon missile weaponeering was introduced to the syllabus taught to officers from the mid-1970s, with the RGM-84 being issued to surface vessels from 1977. (US Navy)

The Harpoon Ship Command-Launch Control System (HSCLCS) provides all display, control, data processing, missile order computations, flight planning, and launcher interface functions for Harpoon employment. HSCLCS allows the operator to tailor the missile capabilities by programming it to a specific engagement plan against a specific target. The HSCLCS consists of the following components:

- Control Indicator Group (CIG)
- Casualty panel
- Launcher switching unit
- Trainer module
- Two-canister missile launchers

The CIG is the heart of the HWS, and it contains the Harpoon Control Console

(HCC) and the WCIP. The CIG receives remote target data, computes fire control equation solutions, monitors the status of the HWS and produces missile and launcher orders. The HCC interfaces with other ship systems, allowing computation of signals for the missiles and launchers. The WCIP is the primary component of the HSCLCS and principal operation station for the HWS. It is used to select, monitor and launch Harpoon missiles. The WCIP provides the operator interface with HSCLCS for the following:

- System self-check
- Status data on missiles and launchers
- Engagement planning functions to input target and related data to missiles
- Launch enable key lock
- Firing switch

For aircraft, there are multiple Harpoon attack modes. The Harpoon missile is capable of engine start after launch or engine start before launch. Each of the Harpoon attack modes provides specialized parameter selection and engagement planning for various employment considerations. Attack modes are:

- Bearing only launch
- Range and bearing
- Designated time on target
- Simultaneous time on target

A typical pre-deployment work-up for Harpoon-equipped ships and A-6 Intruder squadrons was undertaken by Battle Group Foxtrot, centered on the carrier *Enterprise*, prior to the highly eventful WestPac of 1988. As commander of Destroyer Squadron (DESRON) Nine, Capt (later Vice Admiral) James B. Perkins not only planned the attacks on the Iranian GOSPs at the start of Operation *Praying Mantis*, he was also charged with executing the task as commander of SAG Bravo. Perkins described the preparations carried out by Battle Group Foxtrot and the immediate build-up to the event in the article "Operation *Praying Mantis* – The Surface View" published in *Proceedings* in 1989:

For the escorts of Battle Group Foxtrot, preparations for the April 18, 1988 Operation *Praying Mantis* began in the southern California operating area ten months earlier. From this first underway period as a unit, the Battle Group Commander, Rear Admiral Guy Zeller (Commander, Cruiser Destroyer Group Three), had insisted on a rigorous set of exercises to prepare for the upcoming tour on station in the North Arabian Sea (NAS).

Initially, the ships drilled hard at interpreting RoE and at devising means to counter small high-speed surface craft (e.g. Boghammers) and low, slow-flying aircraft – both of which abound in and around the Persian Gulf. We later added exercises stressing anti-Silkworm (an Iranian surface-to-surface missile) tactics, boarding, and search, Sledgehammer (a procedure to vector attack aircraft to a surface threat), convoy escort procedures, naval gunfire support, and mine detection and destruction exercises.

A petty officer instructor from the Fleet Mine Warfare Training Center at Naval Station Charleston, South Carolina, points out features of a Mk 141 canister to a new recruit. The vast majority of US Navy cruisers and destroyers were fitted with Mk 141s, housing RGM-84s, from the late 1970s through to the early 2000s. (US Navy)

We practiced in every environment – in the Bering Sea during November, throughout our transit to the Western Pacific and Indian Ocean, and once on station in the NAS. During the battle group evolution off Hawaii in January [1988], we executed a 96-hour Persian Gulf scenario, with a three-submarine threat overlaid. We conducted live, coordinated Harpoon missile firings in southern California and off Hawaii, dropped Rockeye, Skipper, and LGBs on high-speed targets off Point Mugu and Hawaii, and drilled, drilled, drilled. By late March, each ship had completed dozens of these exercises, and we were considering easing the pace and working on ways to make the exercises more interesting as the day approached when the USS *Forrestal* (CV-59) battle group would relieve us. Such philosophic discussions ended abruptly when *Samuel B. Roberts* hit a mine on April 14.

Four battle group ships en route to a port call in Mombasa, Kenya, were turned around, and *Joseph* and *Bagley* raced north, refueled from USS *Wabash* (AOR-5) and steamed through the Strait of Hormuz at more than 25 knots to join teammates *Merrill* and *Lynde McCormick*. They, and their Middle East Force (MEF) counterparts *Simpson*, *O'Brien*, *Jack Williams*, *Wainwright*, *Gary,* and *Trenton*, repositioned at high speed as the plan was developed. In the NAS, *Enterprise* closed to within 120 nautical miles of the Strait of Hormuz. Its escorts, USS *Reasoner* (FF-1063) and USS *Truxtun* (CGN-35), were stationed to counter the potential small combatant threat in the Strait, and the air threat from Chabahar.

On April 16, I flew with Lt Cdr Mark Kosnik – my one-officer "battle micro staff" – from *Enterprise* to Bahrain at the direction of Commander, Joint Task Force Middle East (CJTFME), Rear Admiral Anthony Less, to assist in planning and executing the response [to the mining of *Samuel B. Roberts*]. We were joined on the CJTFME flagship, USS *Coronado* (AGF-11), by the MEF Destroyer Squadron Commander and began working on the plan with the CJTFME staff and other players. The objectives were clear:

- Sink the Iranian Saam-class frigate *Sabalan* or a suitable substitute.
- Neutralize the surveillance posts on the Sassan and Sirri GOSPs and the Rahkish GOSP, if sinking a ship was not practicable.

There were also a number of caveats (avoid civilian casualties and collateral damage and limit adverse environmental effects) to ensure that this was in fact a "proportional response."

It was a long night, but by 0330 hrs on April 17 we had developed a plan. We formed three surface action groups, each containing both battle group and MEF ships, that were to operate independently but still be mutually supportive. SAG Bravo was assigned Sassan (and Rahkish), SAG Charlie would target Sirri, and SAG Delta would focus on *Sabalan*, should it try and engage the SAGs. *Gary* was our free safety, a lone sentinel on the northern flank protecting the barges [Mobile Sea Bases *Hercules* and *Wimbrown VII*, the former being home to an Atlantic Fleet Naval Special Warfare Task Group and the latter housing one from the Pacific Fleet]. Each SAG commander had an objective and a simple communications plan to direct our forces, to coordinate if required, and to report to CJFTME.

Both GOSPs were to be attacked in the same fashion – we would warn the occupants and give them five minutes to leave the platform, take out any remaining Iranians with naval gunfire, insert a raid force (Marine reconnaissance unit on Sassan and SEALs on Sirri) on the platform, plant demolition charges, and destroy the surveillance post. Col Bill Rakow, Commander of Marine Air-Ground Task Force 2-88, and I developed a plan to coordinate naval gunfire support and AH-1T SeaCobra landing zone preparatory fire, and discussed criteria for committing the raid force, which included the possibilities of die-hard defenders, secondary explosions, and booby traps.

At first light, as SAG Bravo approached the Sassan GOSP, *Trenton* began launching helicopters, including the LAMPS [SH-2 Seasprite] from *Samuel B. Roberts,* which we used for surface surveillance. The GOSP appeared unalerted as we came into view from the southwest and turned to a northerly firing course – our gun target line was limited by a UAE oil field three nautical miles south of Sassan and a large hydrogen sulfide tank on the northern end of the GOSP. H-Hour was set at 0800 hrs.

Capt (later Vice Admiral) James B. Perkins commanded DESRON Nine during *Praying Mantis*, having planned the attacks on the Iranian GOSPs that signaled the start of the one-day war-at-sea. He was very much in the thick of the action as the commander of SAG Bravo. (US Navy)

As previously described in this volume, the subsequent shelling of the two Iranian platforms by the SAGs would quickly provoke a response from the IRIN, IRGC, and the IRIAF. Capt (later Vice Admiral) R. J. "Rocky" Spane, the commanding officer of *Enterprise*, described the resulting action in the April 19, 1988 edition of *The Shuttle* newspaper, published daily onboard the carrier, as "probably the largest US naval battle since World War II. The combined efforts of *Enterprise* and CVW-11 in Battle Group Foxtrot again and again, through exercises, and today – the real thing – has proven to be an unbeatable team; a winner."

Capt Bahram Afzali was made the first commander of the IRIN, which emerged from the IIN after the deposing of the Shah. He remained in this position until early 1983, when he was arrested for belonging to the clandestine communist Tudeh Party of Iran. Afzali was executed on February 25, 1984 after being found guilty of espionage for the USSR. (Public Domain)

LIBYAN NAVY AND IRIN

The navies of Libya and Iran were the smallest branches of their respective armed forces, with the IIN numbering 30,000 men just prior to the revolution in January 1979. The majority of the personnel serving with both navies were conscripts, and in the IIN, selected men had their service extended in seven-year increments. Prior to the revolution, IIN officers were graduates of either the Ground Forces Academy or major educational institutions in Britain, France, West Germany, or Italy – all countries that supplied the IIN with warships and weaponry.

After the overthrow of the Pahlavi dynasty headed by the last Shah of Iran, Mohammed Reza Pahlavi, IIN personnel were described as being "generally supportive of the revolution." Nevertheless, the regime now in power in Iran commenced a major demobilization of the armed forces, and the newly retitled IRIN was not spared. More than 120 of its senior officers had been purged by mid-1980, and the IRIN was reduced in size to 22,000 personnel. Capt Bahram Afzali was given command of the navy, and one of his first tasks was to rename warships in order to remove any link with the IIN and the deposed Shah.

In terms of its organization, the IRIN remained largely unchanged. As had been the case pre-revolution, its operating area was divided into four districts. The majority of its warships were shared between the 1st, 2nd, and 3rd Districts in the Persian Gulf, with the 4th headquartered in Bandar Anzali, on the Caspian Sea coast. The 28th Parallel served as the boundary between the 1st and 2nd Districts, with the Bandar Abbas Fleet Command Post controlling their activities. The 3rd District was a port defense organization that was eventually headquartered at Bandar Shapour/Bandar Khomeini.

Following the revolution, all officer training was undertaken in Iran at the main training center in Bandar Anzali – it featured simulators for crews destined to serve on board Kaman-class fast attack craft. A small number of cadets also undertook courses at the Indian Defence Service Staff College in Tamil Nadu.

The Libyan Army and LAAF relied heavily on Soviet and foreign advisors and support personnel when it came to effectively integrating and operating their sophisticated weapons systems, air-search radar and aircraft. This was also the case with the Libyan Navy, which had received Soviet-built Foxtrot-class submarines and four Nanuchka II-class corvettes in the early 1980s. It had operated Osa-class missile boats and Jaguar-class fast attack craft for a number of years prior to the arrival of the submarines and corvettes. Despite access to Soviet know-how and spare parts, the operability of the more sophisticated vessels supplied to the Libyan Navy was generally poor. Indeed, the submarines rarely ventured out of port from 1984. Better success was enjoyed with its Italian- and French-built corvettes and fast attack craft, which proved more durable and user-friendly for locally trained crews than the Soviet warships.

Serviceability issues also afflicted the IRIN following the Western embargo on military sales to Iran in the wake of the revolution. As previously noted, only a handful of the 60 RGM-84As ordered by the IIN were delivered, and a lack of parts for the various radar and weapon systems installed in the Saam- and Kaman-class warships had rendered them considerably less effective by the time of Operation *Praying Mantis*. Nevertheless, the sailors manning *Sahand*, *Sablan*, and *Joshan*, as well as the IRGCN Boghammer speed boats, did not baulk at engaging a vastly superior enemy when ordered to do so.

COMBAT

In this chapter, US personnel directly involved in the employment of Harpoon missiles during Operations *Prairie Fire* and *Praying Mantis* give their accounts of the actions they participated in. No balanced first-hand reports by Libyan or Iranian personnel who were on the receiving end of the US Navy's ASM attacks have been found.

OPERATION *PRAIRIE FIRE*

On March 24, 1986, the SAG comprising *Ticonderoga*, *Scott,* and *Caron* crossed the "Line of Death" as part of Operation *Attain Document III*. F-14s covering the vessels were targeted by Libyan SA-2 and SA-5 SAMs over the next 24 hours, resulting in the instigation of Operation *Prairie Fire* by Sixth Fleet's Task Force Zulu. NFO Lt Dave Parsons was strapped into the back seat of one of the Tomcats that was targeted:

> I was assigned to VF-102 "Diamondbacks," flying F-14As off *America*. We had conducted a no notice deployment in February 1986 to join *Saratoga* and *Coral Sea* off Libya to challenge Gaddafi's "Line of Death." With three carriers on station, we knew there would likely be a confrontation. We were issued sidearms for the first time in my career.
>
> At 1352 hrs on March 24, we were underway on the wing of Lt Roy "Flash" Gordon, who flew with the skipper, Cdr Mike "Sparky" Lyle, as his RIO. Once on station [replacing a pair of VF-33 F-14s also from *America* that had intercepted two LAAF MiG-25s, which had then broken off the engagement just prior to the Tomcat crews being given permission to open fire], we flew a race-track pattern. "Flash" and "Sparky" were flying south, we north, when "Sparky's" AWG-9 radar picked up a contact about 60 miles away. "Flash" turned in, thinking this would be another MiG-25 coming directly at him. "Sparky" locked onto the contact and "Flash" followed the target symbol in his head-up display, seeing the target accelerate through Mach 1, Mach 2, and Mach 3. He then spotted a

vertical contrail. Moments later, we received a coded message via data link that the Libyans had fired an SA-5 at us. That's when we realized the radar contact must be a SAM. We retired northwards via a split-s maneuver while other assets confirmed our diagnosis.

Two SA-5s had in fact been fired by the battery at Sirte following a direct order by Gaddafi himself. The SAMs missed. Once it had been ascertained that the Libyans had indeed committed a hostile act, the US Navy now had the opportunity to strike back. Vice Admiral Kelso duly sent a flash precedence message to all warships in Task Force Zulu at 1538 hrs, informing them that contingency operation *Prairie Fire* had now commenced. This authorized warships and carrier-based aircraft to "engage Libyan units closing on the force in international waters and airspace."

More clashes between LAAF MiG-25s and US Navy Tomcats and Hornets ensued, but these ended without any aircraft from either side being shot down. At 1830 hrs, two A-7Es armed with AGM-88s commenced an abortive attack on the Sirte SAM battery, but this was abandoned when they were targeted by two SA-5s and an SA-2. Ninety minutes later, the Otomat ASM-armed fast attack craft *Waheed* of the Libyan Navy was detected by both an E-2C and *Ticonderoga* heading northwest at 24 knots from the naval base near Misratah directly towards the SAG. A SUCAP section of two A-6Es was immediately vectored towards *Waheed* by the Hawkeye, the Intruders from VA-34 being armed with AGM-84s and Mk 20 Rockeye II CBUs. Flying the second A-6E was Lt Mike Dowty:

My B/N, Lt Cdr Larry Schofield, and I made an evening launch [in "Blaster 507"] from *America*. We carried one AGM-84 Harpoon and two Rockeye cluster bombs. Lt Cdr Don Watkins launched before us, and our squadron CO, Cdr "Breeze" Coleman, flew an A-6 in tanker configuration. We were tasked with performing an ASUW [anti-surface warfare] patrol, during which we would check out any surface contacts assigned. If there were none previously identified, we would search assigned sectors, flying at around 3,000–5,000ft and 200 knots. Our radar would typically pick up contacts at around 30–50 miles, depending on a number of variables. We would report our contacts to "center" either directly or via a controlling E-2C. They would usually ask us to get a closer look with FLIR [forward-looking infrared], so we'd move to within a couple of miles at lower altitude and higher speed. If the contact was of interest, we were asked to "bird-dog" [maintain contact].

Lt Mike Dowty (right) of VA-34 prepares to fly an *Attain Document III* mission from *America* in a fully armed A-6E 24 hours before *Prairie Fire*. The following day, he and his B/N would become the first US Naval Aviators to fire a Harpoon in anger. (US Navy)

As noted by Dowty, Lt Cdr Watkins and B/N Lt Rick Serex were flying just ahead of him and Schofield. According to Watkins:

About half-an-hour into the flight [in "Blaster 505"], I was vectored towards a surface contact by our early warning, command and control E-2C aircraft and tasked with identifying it. Using our FLIR, we were able to identify the surface vessel as a La Combattante fast attack class patrol boat [*Waheed*], and reported its position, heading and speed back to the E-2C.

Our instructions were to "bird-dog" with the ship – something we had a lot of practice doing during years of Cold War operations against the Soviets. After approximately 20 minutes (at around 2015 hrs local time), we received coded orders to attack the ship. As we verified the order to attack was legitimate, I was slightly to the southwest of the vessel, and we could see commercial shipping just to the north of the patrol craft. While the early versions of the Harpoon could limit the size of its search area to some degree, we weren't altogether comfortable that its radar wouldn't lock onto a larger commercial vessel in the vicinity, vice the smaller patrol craft. Because of this constraint to the weapon, our CO [Cdr Richard G. Coleman] told us that if we did happen to engage any surface ships, we could only shoot Harpoons from north to south. Therefore, I began to maneuver around to the north, which would enable us to fire with a clear shot to the south.

Although "Blaster 505" had been the first to identify the contact, it was actually "Blaster 507" that was better positioned to attack. Dowty recalled:

We checked in with the E-2Cs and they told us "we have a couple of contacts – we want you to go 'bird-dog' one coming out of Tripoli." The controllers then said, "'Blaster 505,' go check this one out (it was the closer one) and 'Blaster 507,' go east." We headed east and joined up with two A-7s, and when we got a bit more than halfway to our target, Don Watkins came up and identified the boat by type – we had a code word that night for a La Combattante-class patrol boat and another for the larger Nanuchka-class corvette. He identified it, and we then heard "alpha sierra passes stable." According to the code words written on my knee board, this meant "ATTACK!"

A-6E INTRUDER

A-6E Intruder BuNo 161667 "Blaster 507" was the aircraft crewed by Lt Mike Dowty (pilot) and Lt Cdr Larry Schofield (B/N) in the attack on *Waheed* on March 24, 1986. Aside from the single Harpoon carried by the aircraft, it also had two Mk 20 Rockeye II CBUs affixed to a pylon beneath the starboard wing. "Blaster 507" made the first AGM-84 attack on *Waheed*, firing the weapon from 22 miles. The crew then bombed the vessel with both Rockeyes.

Lt Rick Serex (B/N) and his pilot Lt Cdr Don Watkins of VA-34 pose with an AGM-84C-1 attached to an underwing stores pylon of an Intruder on the flightdeck of *America* during the 1986 Mediterranean deployment. They fired the second Harpoon at *Waheed* on March 24, despite being the first Intruder crew to positively identify the vessel during their ASUW patrol. (US Navy)

I now knew I had to turn around and speed west, so I asked the E-2C controller, "Anything out there?," to which he answered, "Negative." So, I told Larry, "Get on that radar and check." He did not see anything but one blip. We were at about 3,000ft, headed west-southwest, and it was dark, but there was moonlight. We shot the Harpoon at a range of about 22 miles. I looked out and saw the missile fall away from the jet. I watched it drop into the darkness and then the motor fired up and it sped out in front of us, but it did not seem to be traveling all that much faster than we were. We were turning away from the target when the Harpoon hit. Don Watkins and others saw the impact, but we did not.

Watkins did indeed see "Blaster 507's" missile strike its target:

As we circled back to the north, "Blaster 507" attacked from a more northeast to southwest approach, and were able to execute the first clear shot. Their Harpoon clearly struck the La Combattante's superstructure, before exploding a fraction of a second later, and they continued their attack, dropping their Rockeye.

Dowty described the follow-up attack with Mk 20 Rockeye CBUs as follows:

The only other radio comms I heard were from Don Watkins. He was loitering around the target, but he was not getting a good BIT [built-in test] check from his Harpoon. So, after our Harpoon hit, we set up for a follow up-attack with Rockeye cluster bombs. However, we screwed up the first pass due to FLIR and computer issues, so we had to circle around for another go, from a north-to-south angle.

The FLIR was stuck, so I said we would circle around to put the target in the moonlight. I told Larry, "We are going to step up the altitude to 500ft so we can get a good radar lock, and you will have time to sweeten the angles for a successful bombing attack." Larry replied, "Skipper said never go back and reattack the same target again!" I said, "They are not shooting at us, so we are going back!" So, we bombed the ship with Rockeye. As we pulled away, Don Watkins called "Bulldog away," which meant he was firing his Harpoon at the target.

Watkins recalled "Blaster 505's" AGM-84 attack:

As "Blaster 507" cleared the target, we were then in position to fire. Our Harpoon struck the Libyan craft, which was left totally dead in the water. As we continued towards the vessel, we could see that only the bow of the ship remained afloat, with the bulk of it engulfed in flames. Seeing the ship on the verge of sinking, and believing there may be

other threats to the fleet, we decided to retain our Rockeye in case they might be needed against any other Libyan naval vessels in the area. When our fuel began to run low we returned to the ship.

The next morning the Spanish tanker SS *Castillo de Ricote* rescued 17 Libyan survivors from *Waheed*. According to VA-34's mission write-up, "Intruder crews learned from the attack that it is fairly easy to severely damage and stop a ship, especially one with exposed missiles topside. However, the ship's structural compartmentalization can make it much more difficult to sink."

Four A-7Es from *Saratoga* reattacked the 5N62 "Square Pair" radar used by the Sirte SA-5s at 2100 hrs, with this strike giving the AGM-88 HARM its operational debut. One missile narrowly missed its target, but the other weapon scored a direct hit on the radar antenna. Less than an hour later, the Nanuchka II-class corvette *Ain Mara*, armed with four P-15 Termit ASMs, was detected by an E-2C and *Yorktown* heading west from Benghazi. It would soon be engaged by two A-6Es from VA-85 on a SUCAP from *Saratoga*, with the Intruder section being led by squadron executive officer Cdr Robert Tolhurst:

Our ship, *Saratoga*, covered the midnight to noon cycle [GMT, not local time]. When we launched, we knew nothing about what had happened with the jets from *America* just an hour or so earlier. We were also totally unaware that there was a Libyan warship out there. After being shot off the carrier, we were given a steering vector and told to "Buster," which meant hurry up. Then we were told to go and hit the target. When we arrived, the vessel was just sitting there, looking okay, but not moving. We bombed it with Rockeye and then flew in one big circle around the warship. By the time we had flown all the way around it, we could see a fire starting below deck.

Tolhurst had chosen to hit *Ain Mara* with CBUs rather than a Harpoon due to the presence of civilian vessels in the area. Taking advantage of this, the skipper of the burning corvette maneuvered his vessel towards a nearby merchant ship, thus preventing the circling A-6s from targeting *Ain Mara* with a Harpoon or more CBUs. Forced to abort their attack, the Intruders returned to *Saratoga* and the warship limped back into port with its radar and other electronics destroyed and the superstructure badly damaged.

Later reports indicated that Tolhurst and his B/N had been lucky, for *Ain Mara* was equipped with a radar-guided 4K33 Osa (SA-N-4) SAM launcher which was loaded and elevated in the firing position. The corvette also had radar-guided 57mm guns.

The targets for the next three Harpoon launches, which took place just 15 minutes apart, remain unclear. Both involved cruisers acting as anti-aircraft picket ships for Task Force Zulu, and they saw RGM-84s expended for the first time in anger by US Navy warships. The first weapon was fired by the Leahy-class cruiser *Richmond K. Turner* at 2350 hrs after it had approached the Libyan coast to investigate reports that a Tomcat crew on CAP Station 5 north of Misratah had been fired on by AAA and locked up by fire-control radar. PO Dennis Cain was an air intercept controller (AIC) manning an airborne control station in *Richmond K. Turner*'s CIC that night:

The situation in the CIC was tense, for the Libyans had fired SAMs at our aircraft and, under the cover of darkness, sent out warships armed with ASMs to attack us. I was at

my AIC station monitoring the F-14 CAP. The two-aircraft sections from VF-102 and VF-33 were flying circles at around 20,000ft, and I was talking with the crews via radio. We were near the furthest east CAP station.

Near midnight on March 24, the pilots on CAP called out the code word "Firefly Scram North," which meant they were being fired on by a surface ship. An E-2C confirmed some sort of surface track in its system in this area. Our EW operator confirmed a cross-fix of a radar from a small fast attack craft in the same location.

Lt Cdr Craig Baranowski was our Operations Officer [OPO], and he managed us in the CIC. The station next to me was the location where we controlled surface warfare and employment of the Harpoon. The surface warfare operator, PO David Huddleston, put in data for a long-range shot of the Harpoon at the surface target. We had the data from the E-2C, the EW fix, and our other information to effectively set up targeting for the launch of a Harpoon. We were headed east on a course of 090 degrees, and a Soviet Krivak-class frigate was very close to us. After a lot of radio discussion, the ship's CO, Capt John D. Luke, finally told us to fire.

When we fired the Harpoon, it went over the Soviet ship and headed southwest toward the target, which was more than 50 miles away. Our senior command center leader yelled, "Watch your scopes, as you know they might shoot back!" We thought a Libyan La Combattante-class patrol boat armed with Italian Otomat ASMs was out there trying to hit our ships.

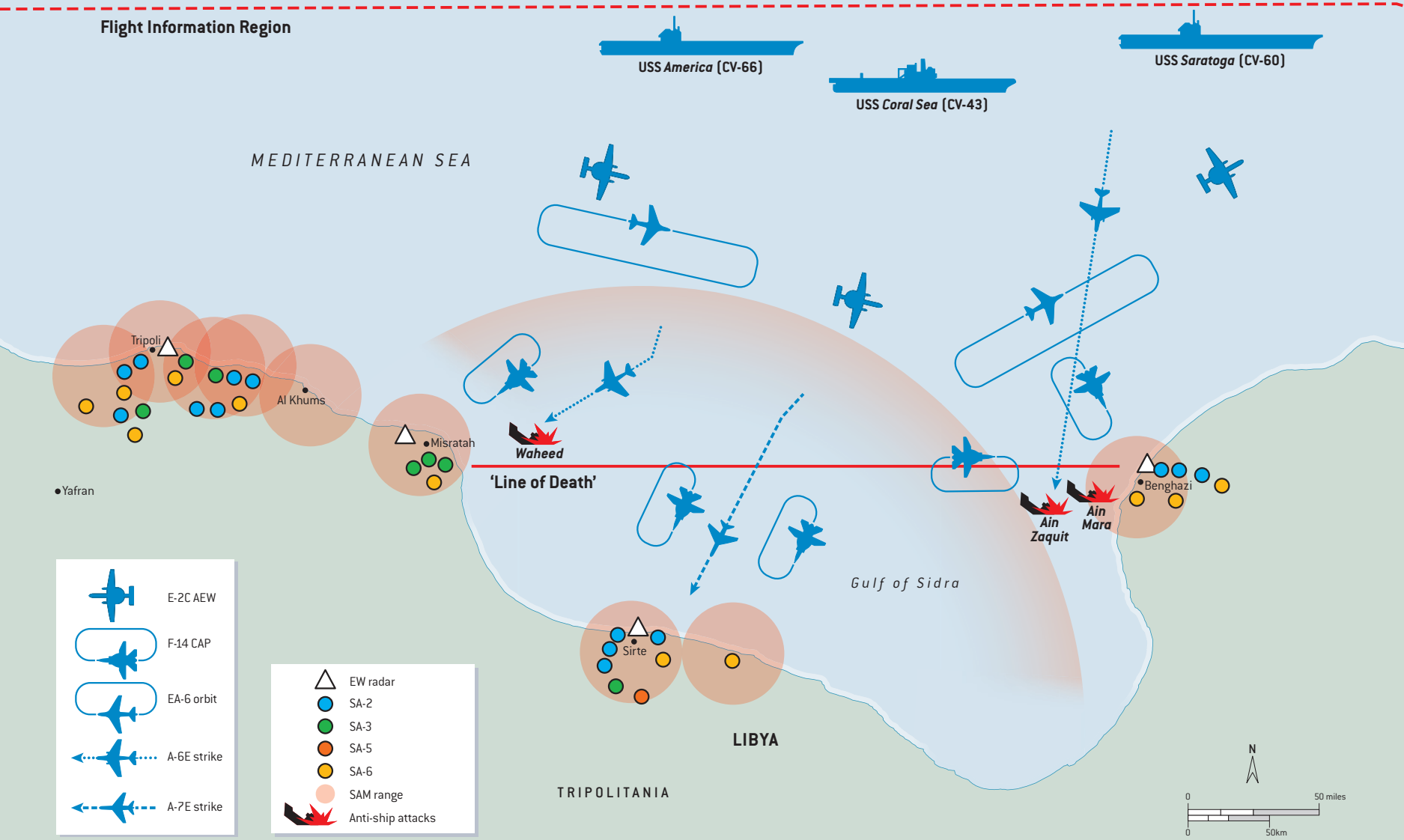
As noted by PO Dennis Cain, surface warfare operator PO2 David Huddleston played a key role in this missile shoot. He recalled:

We were on 12-hour shifts – and close to a shift change – when General Quarters was called. Between 2300 and 2400 hrs, I was operating the NC-2 plotter that was used for calculating the firing solution for the Harpoon. Capt Luke was in the CIC at that time, and he was requesting permission to fire but was denied multiple times. However, we were within range of the La Combattante's ASMs and we had to protect ourselves and the three carriers. Capt Luke was forced into making the decision to expend the Harpoon missile. We fired over the bow of a Soviet Krivak-class frigate, but warned its crew in advance by signal light.

Lt Cdr Craig Baranowski entered the CIC just as things began to hot up:

I had come up for the mid-watch, and was greeted by a lot of activity. Having asked what was going on, I was quickly told that the F-14 CAP under our control had had a fire control lock-on accompanied by "flashes" from the water. There was also a surface fix, and I asked for the contact's bearing and range. It was something like 275 degrees at about 54 miles. I said, "Harpoon missile, bearing-only launch with a seeker turn-on at 30 miles." I believe it was Capt Luke that told me he couldn't do that because he had a Russian frigate on the beam blocking the firing bearing at about 2,000 yards. I said, "Well, in theory, the Harpoons are canister-mounted 45 degrees off of the bow. When fired, they'll come out of the launcher, travel about 1,500 yards, and then turn to the firing bearing. It should cross the bow of the Russian vessel by about 1,500 yards, and then look for the target." He replied, "What do you mean, 'In theory'?" I told him it had never been done before. Nevertheless, he fired the missile.

OPPOSITE
This detailed map shows all the primary actions of Operation *Prairie Fire* on March 24–25, 1986.


Flight Information Region
USS America (CV-66)
USS Coral Sea (CV-43)
USS Saratoga (CV-60)
MEDITERRANEAN SEA
Tripoli
Al Khums
Misratah
Yafran
Waheed
'Line of Death'
Benghazi
Ain Zaquit
Ain Mara
Gulf of Sidra
Sirte
LIBYA
TRIPOLITANIA
E-2C AEW
F-14 CAP
EA-6 orbit
A-6E strike
A-7E strike
EW radar
SA-2
SA-3
SA-5
SA-6
SAM range
Anti-ship attacks
N
0
50 miles
0
50km

> Over the years, having looked back at the engagements that took place during *Prairie Fire*, there is something that I often think about. I believe that the Russian frigate was providing targeting data to that Libyan missile boat. I only really understood how the missile worked because they sent me to "Harpoon school" [Surface Warfare Officers School Command at Naval Station Newport] back when I was a "Jaygee" [junior grade lieutenant], and it was so new that I took in every word.

Although the ship claimed a hit with its Harpoon, the E-2C tracking this engagement reported no solid radar contact. Later, a pair of A-6Es on a SUCAP flight searched the area where the missile had supposedly hit its target, but because it was dark no debris was found.

Although it was a VF-33 crew that reported seeing AAA and being locked up by a fire-control radar, a similar thing happened to a VF-102 aircraft at virtually the same time. This incident again saw Lt Dave Parsons in the thick of the action whilst flying his second sortie of the day:

> *America*'s two Tomcat units flew CAPs 24/7 south of the infamous "Line of Death." I was crewed with Lt Len "Grinch" Colter on a CAP mission on the night of March 24. At around 2230 Zulu [GMT] hrs, while flying at about 20,000ft in a racetrack pattern that allowed us to look southward at Libya, I saw several flashes like large tracer rounds behind us, passing upward through the clouds. Figuring it had to be radar-guided AAA, my right hand immediately went to the chaff/flare dispenser and I started firing off chaff while we discussed what the heck could hit us at that altitude?
>
> We reported this situation to the controlling E-2C from VAW-123 that was monitoring the CAP stations and headed away from the orbit so we could put some distance between us and whatever might be on the surface trying to shoot us down. I checked to make sure our RHAW [radar homing and warning] gear was on and the volume turned up. I put the radar into pulse mode to look for surface targets. Before we got very far, I heard *Richmond K. Turner* make a radio call that "Bulldog was on the way." That made me think they had detected something on their radar, and had launched a Harpoon in response. We then moved southbound to steer clear of that area. There was so much going on, and so much uncertainty, that we never found out what exactly transpired.

Yorktown also engaged an unknown target shortly after midnight, firing a pair of Harpoons into the night sky. It had first started tracking the contact at around 2300 hrs, and a pair of A-6Es on a SUCAP were sent to see what the cruiser had detected. They failed to find anything. When the same contact appeared to be making a turn for the center of Task Force Zulu and accelerating on a heading toward it (specifically *Coral Sea*, which was refueling from USS *Detroit* (AOE-4) at the time), *Yorktown*'s skipper, Capt Carl A. Anderson, gave the order to fire two RGM-84As at a range of just 11 miles from the target.

PO Jim Green was a surface warfare supervisor in *Yorktown*'s CIC on the night of March 24–25:

I came on duty early so I could check out the situation. At around 2300 hrs we spotted a surface radar contact at true bearing 120–150 degrees at a range of about 17 miles that I thought looked like a false track. I was pretty experienced with *Yorktown*'s (then) advanced AN/SPY-1A radar. This operated in a different manner from older radars on other ships in Task Force Zulu. All readouts were digital, but sometimes you could receive ghost images from high wave sea spray [and the water was indeed "choppy" that night] due to processing, but they were pretty easy to spot. However, when the target continued, and even accelerated toward us, it looked real. When it got to a distance of 13 miles and accelerated to past 25 knots, Cdr Rick Easton, the TAO in the CIC, went to General Quarters (which instructed the crew to man battle stations) and ordered that the ship be turned to starboard and its speed increased to more than 30 knots.

A surface warfare supervisor monitors the illuminated screen of his console in the CIC on board USS *Normandy* (CG-60) during a Persian Gulf deployment in 1997. *Yorktown*'s CIC looked identical to this during the night of March 24–25, when its crew fired two RGM-84s at what was thought to be a surface target at a distance of just 11 miles. (US Navy)

Vice Admiral Richard Dunleavy [Commander, Naval Air Forces, Atlantic Fleet] was visiting our ship to monitor the action. Our CO, Capt Anderson, was a very experienced officer, and he had already prepared a Harpoon engagement plan just in case we had to deal with Libyan surface threats. At this time our ship had the AN/SWG-1(V) Harpoon Ship Command Launch System which prepared the RGM-84As loaded in Mk 141 canisters on the stern. This was a pretty basic set-up compared to Harpoon system fitments in later-build Ticonderoga-class cruisers.

Once we saw the possible threat come to within 11 miles of us, Capt Anderson ordered, "Shoot, damn it, shoot!" We had some issues with our primary launch console, so we moved to the Anti-Submarine Air Control unit. My immediate boss, Lt Lee Cardwell, put the command key into the launch system and turned the handle to start the launch process, which fed the bearing and range to the missile. At this point, you received a light indicating the Harpoon booster was armed, the missile was ready and, when the light went out, it fired. However, we got an indication that both missiles' one and two were duds for some reason. So, we manually powered-up missiles' three and four and did a quick bearing-only launch, as the captain was really demanding that we get weapons into the air for self-defense!

Since we were in a near-war footing, we had lookouts stationed around the ship. In this high stress situation, we forgot to alert the lookout, a guy named McGee, in the rear near the canisters. When the missiles fired, he jumped so high he ripped off his headset! We quickly saw flashes as the weapons struck something – the target was not far away.

I got on the radio and called *Saratoga* and told them we had fired, and then requested that they launch the SUCAP to search where the missiles had detonated. The A-6s came out and searched the area, but it was very dark and they found nothing. However, in the morning, when it was light, we saw floating debris, so Capt Anderson and our combat action team believed we had hit something. Later, senior officers told us we had fired at a radar echo.

The US Navy's Office of Naval Intelligence eventually concluded that operators of the ship's AN/SPY-1A radar had misclassified an aerial contact as a surface target.

The final engagement of *Prairie Fire* took place at roughly 0600 hrs on March 25, shortly after an E-2C had detected what was believed to be another La Combattante II-class patrol boat exiting Benghazi at 25 knots. What subsequently proved to be a misidentification by the Hawkeye could have been a fatal mistake for the Intruder crews sent to engage the contact, as they were expecting to attack a French-built patrol boat that lacked SAM protection. In reality, their actual target was the bigger, better-armed Nanuchka II-class corvette *Ain Zaquit*, which had both 4K33 Osa SAMs forward and radar-guided twin 57mm cannon in a single turret aft.

The B/N of one of the two Intruders tasked with investigating the contact was Lt(jg) Ben Loyola of VA-85, embarked in *Saratoga*:

> I was on my very first deployment, having joined the squadron right out of training. My pilot, Lt Keith "Rat" Retterer, was a one cruise "veteran." We were on the flight schedule for a very early launch with a SUCAP lead. Our jet was carrying a Harpoon, several Rockeye CBUs cluster bombs, and a centerline fuel tank. While we were on the catapult, we got a call from "tactical" in *Saratoga*'s CIC telling us that once we had launched we were to go straight into action. I asked "Rat," "Is this usual?," and he replied, "No way!" So, we launched, pressed on to the coordinates and I picked up the ship on radar. There was another A-6 out there from *Coral Sea*. As its pilot was senior, he took the lead. They attacked with Rockeye, but the ship kept coming.

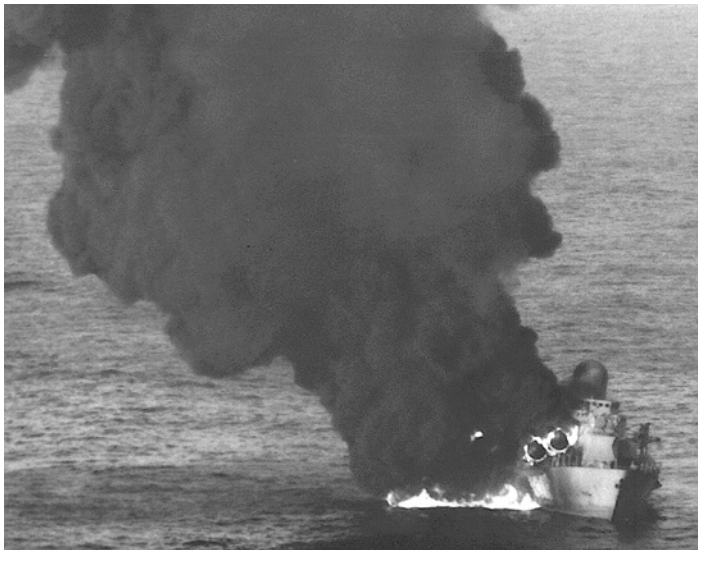
The VA-55 jet from *Coral Sea* expended two CBUs in a single pass, and although they caused some damage, the bomblets failed to set the corvette on fire. According to the unnamed pilot of the aircraft, "This attack was carried out within the SA-2 defensive ring [around Benghazi], right off the beach, but no SAMs were launched because the A-6s stayed at 300ft or lower! The MiGs stayed home too, even though we were pretty close to Benina air base."

With *Ain Zaquit* maintaining its speed and course, it was up to VA-85 to sink the warship. As Loyola recalled, their target had now been correctly identified:

> Now it was daylight, we looked at the ship on the FLIR and confirmed it as a Nanuchka, which was armed with SA-N-4 radar-guided SAMs and multiple guns. Seeking permission to fire a Harpoon, we called the E-2C that was running the engagement as it was in direct contact with the surface warfare commander aboard *Saratoga*. The controller aboard the Hawkeye quickly replied, "Affirmative, you have clearance to attack," so we set up for a Harpoon shot.
>
> As we came toward the ship, he lit us up with his fire-control radar for both the SAM and guns. Our radar warning receiver was going crazy

Lt(jg) Ben Loyola and Lt Keith Retterer pose with VA-85's "Buckeye 501," which was adorned with two Nanuchka II silhouettes marking the unit's involvement in the crippling of *Ain Mara* and the sinking of *Ain Zaquit*. (US Navy)

with visual and audio indications, and that got our attention. We dropped down, popped chaff and flares, and started jinking back and forth as we continued to head in. We wanted to get the radar in the Harpoon's homing head to see the target before the missile was launched, so we popped up. When we got that indication, we launched. The Harpoon is a sea-skimming missile, so we followed it down. The missile bored in and hit the ship just behind the stack, causing a big explosion. I had a couple of cameras with me, and we flew around the ship. One of my photographs was run on the covers of both *Time* and *Newsweek* soon after.



This photograph, taken by Lt(jg) Ben Loyola of VA-85, reveals the mortal damage inflicted on *Ain Zaquit* by a single Harpoon and three Rockeye CBUs shortly after dawn on March 25. Loyola and his pilot, Lt Keith Retterer, fired the AGM-84 that hit the corvette. Both *Time* and *Newsweek* ran this image on their covers shortly after *Prairie Fire*. (US Navy)

Lt Keith Retterer praised the range at which the AGM-84A could be fired from the target – his B/N had launched the missile more than 30 miles from *Ain Zaquit:*

> The Harpoon's range gave us a great advantage. During this attack, we could stay outside gun or SAM range and not be in any danger of getting shot at, yet still shoot and kill the ship. The shot went really smoothly. The targeting and launch went just the way it was supposed to. It went in pretty quick, and I doubt the Libyans saw it coming.
>
> That morning was one of the clearest we had had down there. In January and February, every time we went down to the Gulf of Sidra the weather was terrible. It was windy, the sky was overcast, and the seas were high. But not that morning. Visibility was unlimited, and after we hit the Nanuchka II, we could see its column of smoke 20 miles away.

Two more A-6s from VA-85 arrived on the scene shortly after the Harpoon strike, these aircraft being armed with Rockeyes. Each jet hit *Ain Zaquit* with a single CBU from a height of about 500ft, convincing the surviving crewmen to abandon ship.

It was at about this point that both sides backed off and separated to catch their breath. *Saratoga* departed for home and the remaining two carriers returned to routine business with Sixth Fleet. The apparent bloody nose his forces had received did not stop Gaddafi's rhetoric, however, and a week after the confrontation he boldly stated, "We will impose our sovereignty on the Gulf of Sidra with our blood!"

OPERATION *PRAYING MANTIS*

As previously detailed in this volume, at 0804 hrs on April 18, 1988, in retaliation for the mining of *Samuel B. Roberts*, the US Navy commenced Operation *Praying Mantis* when SAG Bravo, consisting of *Merrill*, *Lynde McCormick*, and *Trenton*, started shelling Iranian guns and military installations on the Sassan GOSP. Capt James B. Perkins, commanding SAG Bravo, detailed the opening phase of *Praying Mantis* in his article published in the May 1989 edition of *Proceedings*:

H-Hour was set at 0800 hrs – at 0755 hrs, we warned the Sassan GOSP inhabitants in Farsi and English, "You have five minutes to abandon the platform – I intend to destroy it at 0800hrs." This transmission stimulated a good deal of interest and activity among a growing group of Iranians milling about on the roof of the GOSP's living quarters. Several men manned their 23mm gun and trained it on *Merrill* about 5,000 yards away, but many more headed for the two tugs tied up alongside the platform. One tug left almost immediately, and the other departed with about 30 men on board soon afterward. The VHF radio blared a cacophony of English and Farsi as the GOSP occupants simultaneously reported to (screamed at) naval headquarters and pleaded with us for more time.

At 0804 hrs, we told the inhabitants that their time was up, and commenced firing at the gun emplacement. This was not a classic NGFS [naval gunfire support] mission. I had decided on airbursts over the GOSP to pin down personnel and destroy command-and-control antennae, but to avoid holing potential helicopter landing surfaces.

At the first muzzle flash from *Merrill*'s 5-in. mount 51, the Iranian 23mm gun mount opened up, getting the attention of the ship's bridge and topside watchstanders. *Merrill* immediately silenced the Iranian gun with a direct hit, and encountered no further opposition. After about 50 rounds had exploded over the southern half of the GOSP, a large crowd of converted martyrs gathered at the northern end. At this point, we checked fire and permitted a tug to return and pick up what appeared to be the rest of the Sassan GOSP occupants.

Following this exodus, *Merrill* and *Lynde McCormick* alternated firing airbursts over the entire GOSP (less the hydrogen sulfide tank), and we watched the platform closely for any sign of activity, but saw none. As this preparatory NGFS progressed, Col Rakow and I selected 0925 hrs as the time to land his raid force. In a closely coordinated sequence, the ships checked fire, SeaCobra gunships delivered covering fire, and the UH-1 and CH-46 helicopters inserted Rakow's Marines via fast rope. It was a textbook assault, and I caught myself stopping to admire it.

Despite some tense moments when Iranian ammunition stores cooked off, the platform was fully secured in about 30 minutes, and the demolition and intelligence-gathering teams flew to the GOSP. About two hours later, 1,500lbs of plastic explosives were detonated by remote control, turning the GOSP into an inferno.

Meanwhile, the fog of war had closed in periodically. First, a UAE patrol boat approached at high speed from the northwest. We evaluated it as a possible Boghammer – a popular classification that day. It could be engaged under the ROE, but we just identified it and asked it to remain clear. Later, we reconstituted SAG Bravo and headed north to attack Rahkish GOSP, for no Iranian warship had yet been located and sunk. A SeaCobra helicopter crew – our closest air asset – evaluated a 25-knot contact closing from the northeast as a warship. This quickly took shape as a "possible Iranian *Saam* FFG," and *Merrill* made preparations to launch a Harpoon attack. We then asked for further descriptive information and ultimately for a hull number. The contact turned out to be a Soviet Sovremenny-class DDG [guided-missile destroyer]. The skipper, when asked his intention, replied with a heavy accent, "I vant to take peectures for heestory." We breathed easier.

Shortly after that, SAG Bravo was instructed to proceed at full speed to the eastern Gulf in response to Boghammer attacks in the Mubarek oil field. That ended our participation in the day's fireworks.

The Boghammer threat, however, would be swiftly dealt with by A-6Es from VA-95, as CVW-11's attack squadron became embroiled in *Praying Mantis* for the first time. Lt Cdr Jim Engler led the way for the unit:

The shelling of the Sassan GOSP from 0804 hrs by the warships of SAG Bravo marked the start of *Praying Mantis* on April 18, 1988. This photograph of the charred wreck of the platform was taken by one of the Marines that was lowered onto the Sassan GOSP by helicopter in order to lay demolition charges. The building still clearly burning was the platform's living quarters. (US Navy)

> We had launched with a second A-6, flown by Lt Paul Webb, on a recce mission, with both aircraft carrying a SUCAP load which included a Harpoon, Rockeye CBUs, and an LGB. We also had a dedicated two-aircraft section of F-14 fighter escorts. As we circled east of Oman up in the Straits of Hormuz, we got a call from a controller on board an orbiting E-2C, who said, "We are clearing you into the Gulf. Iranian gunboats are attacking Americans working on an oil platform." Immediately, I knew this was significant, as we had never been cleared to fly into the Gulf before.
>
> Once we reached our target area, I could see small ships converging on the oil platform. I asked the E-2C controller, "Are we cleared to engage?" We wanted to get on the record that we were indeed allowed to employ weapons. We were cleared "Hot," and I made the first run and attacked the closest boat to the platform. I had been told by one of our B/Ns that the Boghammers ALWAYS turned left to avoid bombs, so the gouge was to drop a little long and left. The lead *Boghammer* did as advertised, and was raked by the cluster bomblets – the Rockeye delivers projectiles over an area the size of a football field. My boat went through the pattern, and I knew I hit it, but it kept going, so I cleared my wingman in. He dropped, and our desired effect was to stop the attacks. We achieved this, as they turned around and headed back to their base at Abu Musa Island – they drove the Boghammers right up onto the beach. The crews literally ran out of the front of them and hid in the sand on the shore, while we flew above them watching it happen. We had done what we needed to do.

Meanwhile, nine minutes after SAG Bravo had opened fired on the Sassan GOSP, SAG Charlie, made up of *Wainwright*, *Simpson*, and *Bagley*, targeted the Sirri-D GOSP. The commanding officer of *Simpson* was Capt Jim McTigue, who recalled how the IRIN reacted to the shelling of the GOSPs:

> In an apparent response to the attacks, Iran dispatched the missile-armed patrol vessel *Joshan* to the area where SAG Charlie was operating. At the time, *Joshan* was believed to be the only Iranian surface combatant equipped with operational Harpoons. Our understanding was that she had at least one, and possibly two, functional Harpoons on board. In addition to *Joshan*, it appeared that the Iranians might also respond by coordinating the employment of F-4 Phantom IIs in a simultaneous surface attack with *Joshan* – two Phantom IIs were detected orbiting about 30–35 miles from our SAG.
>
> When *Joshan* was first identified by ESM [electronic support measures] triangulation, followed by a visual sighting from embarked LAMPS helicopters, she was still well over the radar horizon. I directed that a Harpoon be placed on the rail of *Simpson*'s Mk 13

VA-95's "Lizard 501" is guided on to the catapult shuttle on April 18, the aircraft being armed with a single Harpoon, a 500lb GBU-12 LGB, and three Mk 20 Rockeye II CBUs. According to unit CO Cdr Bill Miller, "We married our Harpoons up with the aircraft the day before the war-at-sea. This was because the interface of the Harpoon with the A-6 did not always work, so we took six machines, went through all the checks and found that one pairing was not functioning. We fixed it, and this allowed us to begin patrols early the following morning confident that the six Intruders left armed overnight would perform perfectly." (Tony Holmes Collection)

OPPOSITE

The key actions of Operation *Praying Mantis*, as well as the minefield laid by *Iran Ajr* and the mining of *Samuel B. Roberts* that directly caused the one-day war-at-sea on April 18, 1988, are shown on this map.

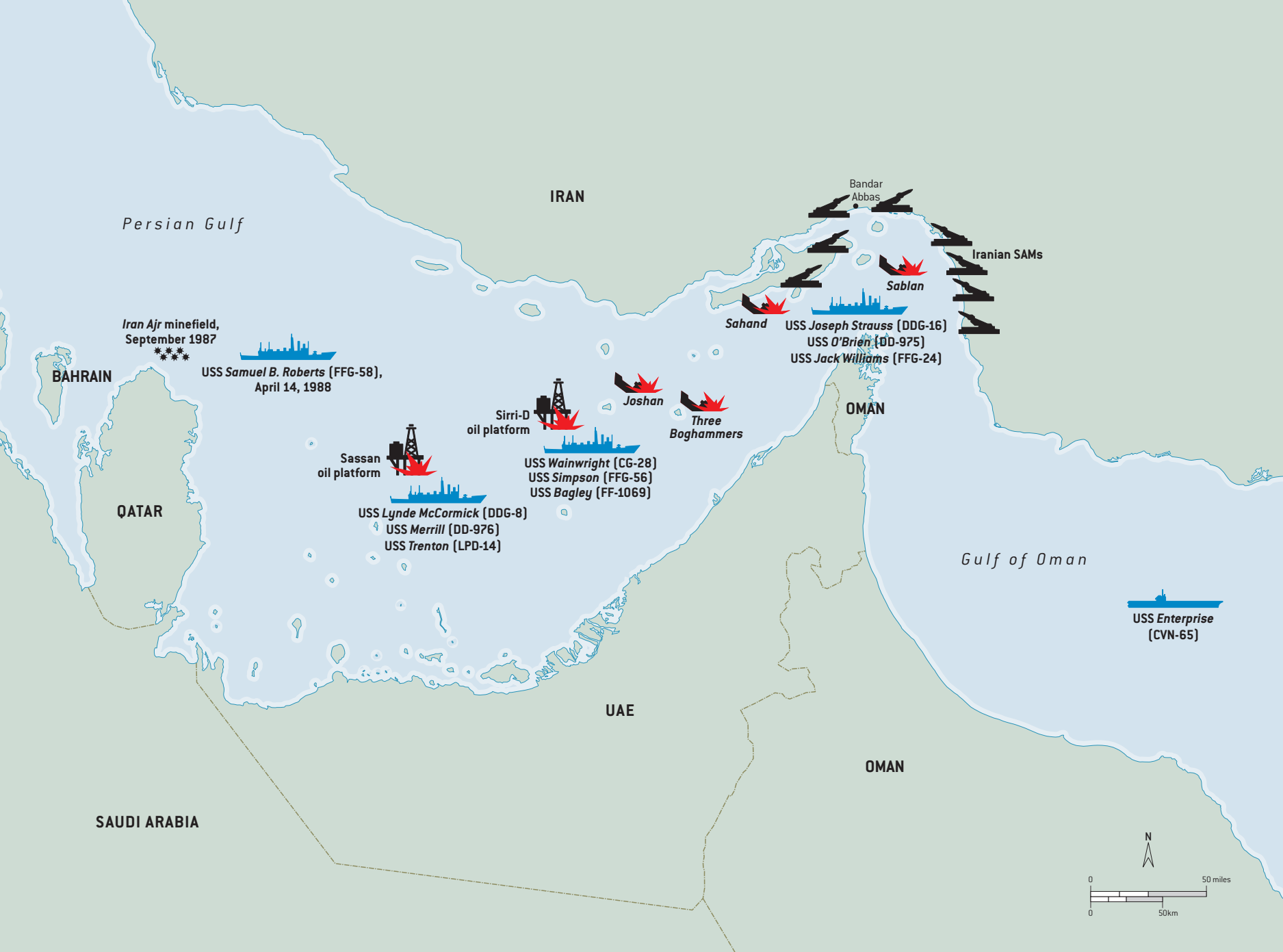
GMLS in anticipation of a possible over-the-horizon tactical engagement – all three ships of SAG Charlie carried Harpoons.

One of the helicopters airborne that morning was the SH-2F Seasprite from HSL-31 embarked in *Bagley*, with Lt(jg) Mark Ouwerkerk at the controls:

When a contact of interest was suspected to be moving towards the SAG, we were tasked to head in that direction. We received specific instructions of what this suspected target was and what characteristics we should try to identify when we got within visual range. We identified the target on radar and began to make our approach, trying to conceal ourselves as best we could in the haze of the day. Once the target detected us on radar, they began the standard challenges that occurred in the Gulf. The challenges became more threatening, changing from "clear our area" to "we will shoot you down!" We remained silent and continued while *Bagley*'s commanding officer came on the radio and said, "We are a US Navy warship, and if you fire on our helicopter, we will sink you."

Due to poor visibility, we had to close to less than a mile to get the confirmation of the Harpoon launcher system on *Joshan*. Once we confirmed that, we turned to clear the ship, and the area, and headed back towards the SAG. We had almost made it back to *Bagley* when we were ordered to return to *Joshan* in order to verify a more specific detail of the vessel. We dropped down and began the same approach process all over again. We got to within about a half-of-a-mile of the warship, at which distance we were able to get a close enough look to verify that it was indeed *Joshan*. Once we had confirmed this, and reported back to *Bagley*, we brought the crewmen who had been using gyro-stabilized binoculars for longer-range surveillance back inside the cabin, closed the doors, and dropped to 20ft above the water to avoid potential shoulder-launched SAMs or gunfire.

We were flying in the direction of the SAG when we heard over the comms that *Joshan* had launched a missile and our vessels were deploying chaff – we moved away from the SAG to avoid damaging our engines by ingesting it. While circling in a starboard


IRAN
Persian Gulf
Bandar Abbas
Iranian SAMs
Sablan
Sahand
USS Joseph Strauss (DDG-16)
USS O'Brien (DD-975)
USS Jack Williams (FFG-24)
Iran Ajr minefield, September 1987
BAHRAIN
USS Samuel B. Roberts (FFG-58), April 14, 1988
Sirri-D oil platform
Joshan
Three Boghammers
OMAN
Sassan oil platform
USS Wainwright (CG-28)
USS Simpson (FFG-56)
USS Bagley (FF-1069)
QATAR
USS Lynde McCormick (DDG-8)
USS Merrill (DD-976)
USS Trenton (LPD-14)
Gulf of Oman
USS Enterprise (CVN-65)
UAE
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SAUDI ARABIA
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Kaman-class fast missile craft *Joshan* fired the first Harpoon to be expended on April 18, and it was swiftly targeted shortly thereafter. It was not the first IRIN La Combattante II-class vessel to be lost in combat, however, for sister-ship *Peykan*, seen here, was sunk by three "Styx" ASMs fired by three Osa-class fast missile craft of the Iraqi Navy on November 29, 1980. The previous month, according to Iranian sources, *Peykan* had become the first warship to fire a Harpoon in anger when it hit an Iraqi Osa-class vessel with a single missile in the Northern Arabian Gulf. (Public Domain)

delta-type pattern, waiting for clearance to land, we heard the warning (to *Joshan*) from *Wainright* to "Abandon ship – we intend to sink you." This was repeated several times as I recall, and continued until seconds after the launch of the first SM-1. Shortly after the missiles had been fired, and appeared to have hit the target, we were called back to *Bagley*.

While the Seasprite was circling nearby, on board *Simpson*, Capt McTigue was preparing to engage *Joshan*:

As *Joshan* continued to close on SAG Charlie, she was warned several times and directed to proceed no further. Nevertheless, *Joshan* persisted in closing, and when she came inside the radar horizon, I had the Harpoon replaced with a Standard SM-1 missile on our launcher because it had both surface-to-air and surface-to-surface capabilities that could be used against either *Joshan* or the Phantom IIs. Two other factors influenced my decision to switch from a Harpoon to a Standard. First, the area where *Joshan* was located included many smaller vessels (dhows, fishing boats, tugs, etc.) which might have made target discrimination more complicated for a Harpoon, and second, the Standard had the time-of-flight advantage of Mach 2.5 speed, as opposed to the Harpoon's Mach 0.8. The SM-1 had a much smaller warhead, however.

Joshan was visually spotted from our bridge at a range of about 12 nautical miles. The presence of two Harpoon canisters on her stern was reported by *Simpson*'s executive officer. *Joshan*'s crew was provided with a final warning to abandon ship before being taken under fire. She responded with the first Harpoon launch of the day. *Wainwright* and *Simpson* launched chaff.

SAG Charlie's commander, Capt Jim Chandler, who was also CO of *Wainwright*, gave me the "batteries released, birds' free" order. *Simpson*'s first SM-1 was launched three seconds later (at 1215 hrs local). The SM-1 scored the first hit on *Joshan* before her Harpoon passed about 100ft down the starboard side of *Wainwright*. If *Joshan* had another Harpoon, she did not have the opportunity to launch it. The CO of *Wainwright* then directed me to take two more follow-on SM-1 shots (at 1217 hrs and 1223 hrs), and followed with one of her own (at 1226 hrs), all of which hit.

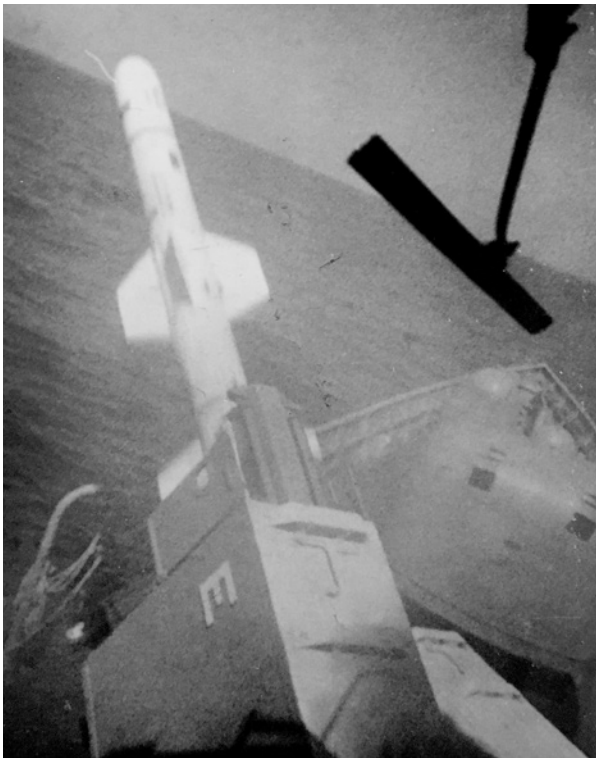
With *Joshan* burning, but apparently not sinking, SAG Charlie was directed to proceed to the west and engage the Phantom IIs, which *Wainwright* did with two Standard-ER SM-2s at 1250 hrs. We were then directed to return to the location of *Joshan* to finish her off. During the run-in toward the target, *Wainwright* detected a possible EW emanation coming from the vessel's direction, and it directed *Simpson* to conduct one more SM-1 shot at 1350 hrs, which was also a hit.

By this point, *Joshan*'s superstructure had been demolished, but her hull continued to float, so *Wainwright* directed *Bagley* to take the first US Harpoon shot of the day at 1358 hrs. Unfortunately, *Bagley*'s SWG-1 system (and the RGM-84A Block 1 missiles on board) supported only a sea-skimming profile, and the Harpoon proceeded to fly directly over the low freeboard of *Joshan*'s hull. Had *Bagley* been able to fire a shallow pop-up

[Harpoon Block 1B/C] guided by the later SWG-1A, it would undoubtedly have scored a hit. The CO of *Wainwright* then directed the three ships to complete the sinking of *Joshan* with gunfire, rather than taking any further missile shots.

According to Lt(jg) Stuart Klearman, Communications Officer on board *Bagley*, the US Navy's classification of the vessel's Harpoon shot as a "miss" was a little harsh:

> That is just not really accurate. *Joshan* was already heavily damaged both by SAMs and naval gunfire. The Harpoon, from my vantage point on the bridge, appeared to be a direct hit on *Joshan*. The signalmen on the signal bridge had the "big eyes" – mounted binoculars – and had a much better view. The Harpoon, being an impact-detonated weapon (not proximity), and lacking the later variants' pop-up feature, flew through what was left of *Joshan*'s superstructure/hull, but did not make a hard impact which would have triggered the warhead. The missile performed as designed. It was just the fluke dynamics of not impacting anything solid that kept the warhead from detonating. Had *Bagley*'s Harpoon been the first weapon fired, it would have devastated *Joshan*.



Bagley's Communications Officer, Lt(jg) Stuart Klearman, took this photograph of the Harpoon fired by the vessel leaving the frigate's ASROC launcher. Seconds later, the weapon flew through what was left of *Joshan*'s superstructure but failed to explode due to it failing to make the hard impact that was needed to trigger the warhead. (Stuart Klearman)

Capt McTigue's summary of SAG Charlie's missile expenditure that day is as follows:

> To the best of my knowledge, the surface-launched missile tally for our portion of *Praying Mantis* included one US Harpoon fired (which passed over the target, but did not detonate) and one Iranian-fired Harpoon which, thankfully, just missed its target. Additionally, five Standard missiles were fired in the surface-to-surface mode, and all bar one hit. One of *Wainwright*'s two Standard-ER SM-2s detonated just behind an Iranian F-4E after its pilot pulled a 12g diving turn to evade the missile. The airframe was sprayed with shrapnel, but it landed at Bandar Abbas with partial hydraulic failure, engine problems, and severe damage to the wings and fuselage.
>
> As far as the three three-ship Surface Action Groups were concerned, SAG Bravo targeted the Sassan GOSP and did not engage any Iranian surface combatants, so no Harpoons were involved in its action. During SAG Delta's action in the Strait of Hormuz, both air- and surface-launched Harpoons were employed in the destruction of *Sahand*, with the two air-launched by VA-95 and the one surface-launched by *Joseph Strauss* all scoring direct hits.

As noted by Capt McTigue, SAG Charlie was led by Capt James C. Chandler on April 18, with his own vessel, *Wainwright*, being in the thick of the action. His analysis of the clash makes for interesting reading:

Joshan's target was *Wainwright*, leading SAG Charlie. It was the closest of three warships to the IRIN vessel, and an airborne LAMPS helicopter first alerted the cruiser to the missile's firing. *Wainwright* successfully defended itself with both active jamming and clouds of chaff, and then engaged *Joshan* with a single SM-2MR fired from its forward missile launcher. (US Navy)

Let me provide a little background so you can perhaps understand some of my decision-making as SAG Charlie commander. While serving as Chief Staff Officer of DESRON 24, we conducted probably no fewer than ten Missile X exercises involving all sorts of missile vessels. Two of the exercises were shooting SAMs in surface-to-surface mode at ship hulls provided by foreign navies in the Mediterranean. Then, while commanding USS *Sampson* (DDG-10), my ship was the test bed for the SM-1 Block 6, firing 26 missiles. Additionally, *Sampson* participated in, as I remember, six additional Missile X exercise, firing four missiles (all Block 6s) in each exercise. In surface-to-surface shots, all missiles were observed to impact the targets in the bridge/superstructure area. I was well aware of the SAM's capability in the surface mode.

Over the years, I was involved in a number of computer-generated tactical in-port training exercises against Soviet vessels, many of which were small missile boats. When these vessels started to close at high-speed, the SAM in surface-to-surface mode was the answer – not waiting for gun range and slow engagement. *Wainwright* practiced this tactic over and over in preparation for the Persian Gulf deployment. SAM in the surface-to-surface mode was an in-the-bag tactic. Additionally, we trained for ECM Harpoon interception, actively jamming and employing chaff against the weapon.

Now to my decision-making as the SAG commander. *Wainwright* was a flag-outfitted cruiser. We had a signals intercept capability that was manned throughout the Middle East deployment, not just for *Praying Mantis*. Additionally, I was able to hear the comms to and from the Pentagon. When the radiations from *Joshan* were first detected, SAG Charlie was directed by Commander, Middle East Force [CMEF] to locate the vessel and on four different occasions directed *not* to sink her. We knew from intercepts it was *Joshan*, and that she was very likely carrying the last Iranian Harpoon. I briefed *Simpson* and *Bagley* that the ship was *Joshan*, and a Harpoon carrier.

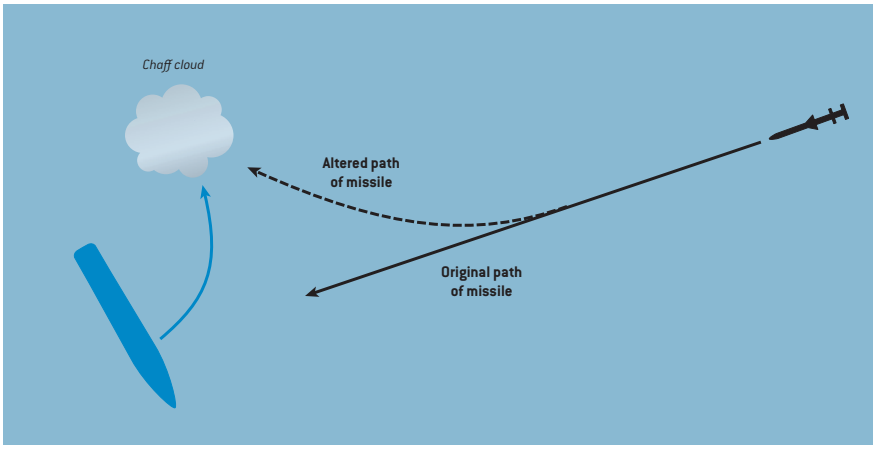
When SAG Charlie located *Joshan* at the initial range, I ordered all three ships to prepare to engage it with Harpoon. When a LAMPS helicopter sighted *Joshan*, he reported that the attack craft was using merchant vessels in the vicinity as a screen. A problem with Harpoon was it did not discriminate amongst vessels. When fired, it was as likely to hit a noncombatant as *Joshan*. I explained that to *Simpson* and *Bagley*, and directed them to prepare a SAM in the surface-to-surface mode and, in the case of *Bagley*, for a gun engagement. As mentioned earlier, I was directed by CMEF not to sink *Joshan* – not an easy order to execute. If you fire for effect, you might very well sink the target.

Wainwright was the ship nearest to *Joshan* as we closed. We reacted very quickly in the wake of *Joshan* firing at us. The first indication a missile had been launched came from a LAMPS helicopter, which reported a cloud of white smoke. The senior chief radar operator reported separation [of the solid rocket booster motor from the weapon] and

OPPOSITE

Wainwright fired its Mk 137 launchers containing Mk 36 SRBOC, which worked in conjunction with the ship's EW sensors to defeat the guidance system in the lone RGM-84 fired by *Joshan*. (US Navy)

the EW chief reported an emitter. As I said, we had trained for this. Things then went into automatic. The EWs, without order, launched chaff and started the active jamming. I told *Simpson* we were locked on and gave Capt McTigue the "birds' free" order to fire his SM-1MR. He fired it immediately. Moments later, we knew *Simpson* had achieved a hit because *Joshan*'s radars went quiet.



The chaff cloud created by *Wainwright*'s Mk 36 SRBOC produced a radar-reflective signal large enough to pull *Joshan*'s Harpoon off its original path and away from its primary target. The missile's guidance system was also affected by heavy electronic countermeasures (active jamming) and maneuvering of the ship.

Why did I choose to use the SAM in the surface-to-surface mode? I think it was the appropriate weapon, given the proximity of other vessels, along with the speed and accuracy of the missile. Past experience paid off. By the way, *Wainwright* did not fire an SM-1. It was an SM-2 shooter.

With *Joshan* having effectively been blinded by the SM-1 hit, I ordered the bridge to steer the ship onto a course that presented the smallest radar aspect to the incoming missile [which, due to its subsonic speed, was still in the air when *Joshan* was hit by the supersonic SM-1MR] and kept it out of line between the missile and our chaff cloud.

The missile passed very close down our starboard side and, by visual report, through the chaff. Now, why the miss? I surmise one of three things – either the missile malfunctioned, the missile settings were wrong, or the actions *Wainwright* took were effective. Later, I considered that we might have had some luck, too.

How does it feel to have a Harpoon fired at you? Too exciting, and too many things to do and think about. One remarkable thing. As I looked around CIC while the missile was inbound, everyone was bent over with knees flexed, holding on to a fixed object.

In respect to our training for countering other ASMs, firstly, all US Navy vessels, I would hope and think, practiced in tactical training how to counter Soviet threat missiles. That was a major concern. When *Wainwright* was informed we would be going to the Persian Gulf rather than Sixth Fleet, we immediately shifted gears to the threat in the region. There were fleet training teams (tremendously helpful), NTDS [Naval Tactical Data System] tape training scenarios, and we also built some of our own. All were very useful.

Every threat missile had different parameters and was associated with specific platforms and radar

emitters. You had to know them and be able to react immediately. We trained, full team, which included the CO and XO, two to three times a week. Only the CO could excuse someone from training, and this never happened! When we received Joint Operational Tactical System training, it was integrated into the training plan. Everyone knew how the captain would fight the ship and everyone knew what their jobs and automatic responses would be without the need for an order, unless it was negated by either myself or the TAO.

One of the major concerns following the April 18 clash with *Joshan* was why did our Phalanx CIWS NOT shoot down the Iranian Harpoon when it was in full auto mode? What happened? I asked my Weapons Officer, who was at my elbow as my TAO, that very question. What we subsequently found out was a huge lesson learned. When you are responsible for weapons systems in a new command, check out the limits on the firing cut-out cams [that protect the CIWS from shooting up its own ship]. We had fired our CIWS numerous times, even in the Persian Gulf, and only a few days before had had a low-level fast aircraft run some tracking passes for us, and all was in order.

However, as in all tracking and firing exercises, the missile profiles were flown over the beams of the ship, and none from forward or aft. On investigation and testing, it was discovered that the limits on the CIWS firing cut-out cams had been changed, unbeknown to me and the weapons officer, by one of my predecessors who was concerned some antennae forward might be shot away. Wrong! The engineers who create those limits know what they are doing. That problem was quickly corrected. So, you have the answer – incorrectly set firing cut-out cams.

Why did I point the bow at the inbound missile? Training! The three primary reasons were as follows. Firstly, during a session with a tactical training team, the leader asked me where was the ship's minimum radar cross section. I replied, "bow." He said, "No, three to five degrees off the bow." Train, remember. Also, CIWS will engage (supposedly).

Secondly, during all my seagoing life, wind direction was kept updated by the quartermasters on a vertical plot in the CIC and on the bridge. The EW specialists and many others kept an eye on that to determine from which side to launch chaff, among many other things. The EW chief was the one who determined on which side to launch chaff (training/automatic response). On April 18, the wind was blowing from port to starboard. The EW chief launched starboard chaff.

A chaff cloud is created by Mk 36 SRBOC canisters ripple-fired from the starboard Mk 137 launcher fitted to a Kidd-class destroyer of the Republic of China Navy during an exercise. Identical scenes took place about 100 yards off *Wainwright*'s starboard beam as the cruiser reacted to *Joshan*'s Harpoon. (US Navy)

Thirdly, the ship had just started an ordered turn to starboard when *Joshan* launched the Harpoon and we launched chaff. The first two points came to mind. Position the bow, and don't place your ship between the inbound missile and the chaff cloud – bad place to be. I ordered hard left rudder to get the bow placed accordingly. Not to be forgotten, the EWs were carrying out active jamming the entire time – training!

In the end, the Iranian missile missed. I will always believe that because of training, with

Mk 15 BLOCK 0 CIWS PHALANX

1. Ku band search radar
2. Ku band low sidelobe tracking and gun laying radar
3. M61A1 Vulcan Gatling-type 20mm rotary cannon
4. Linkless ammunition belt
5. Helical feed ammunition drum

All of the US Navy warships involved in Operations *Prairie Fire* and *Praying Mantis* were fitted with Mk 15 Block 0 Close-In Weapon System (CIWS) Phalanx – the first examples had reached the fleet in 1980, and within five years 400 units had been delivered. The only time it was called into action during either operation was when *Wainwright* was targeted by a Harpoon fired by *Joshan*, and the CIWS failed to engage the ASM when it came within range, despite being in auto mode.

the crew carrying out their jobs, without orders, as they had trained, we defeated the Harpoon. No question the missile was fired at *Wainwright*. Both the bridge watch and personnel reloading the chaff launchers saw it pass through the chaff cloud about 100 yards to starboard, and everyone, including the engineers in the propulsion plant, heard the missile pass. Final result was the missile missed!

An hour after *Bagley*'s near miss in its Harpoon attack on *Joshan*, the Saam-class frigate *Sahand* departed Bandar Abbas and headed south. Its presence had been quickly detected by an E-2C, which immediately requested that SAG Delta (*O'Brien*, *Jack Williams*, and *Joseph Strauss*) search for the frigate. At this point, although the US Navy was aware a vessel had sortied, there was uncertainty as to whether it was *Sahand* or *Sabalan*. Lt Cdr Robert Johnston was the executive officer of *O'Brien*, which was now closing on the IRIN frigate:

We positioned ourselves and waited for him to come out and get farther away from the land so we could engage him. It's not ideal to shoot a Harpoon at a ship that is very close to shore because you have that land background behind you and it has a chance of confusing the radar seeker on the missile. You want to wait until he gets a little bit more out in the blue water.

Both SAG Delta and A-6s and A-7s from *Enterprise* would subsequently be involved in the devastating attack on *Sahand*. Aircraft from CVW-11 had been flying SUCAP and reconnaissance missions from just before dawn, searching primarily for *Sabalan* – one of the key targets of Operation *Praying Mantis*. Finding such a small, gray warship in hazy conditions in the congested waters of the Strait of Hormuz was no easy task, as VA-95's executive officer, Cdr John Schork, recalled:

The most difficult thing was that the area was chock full of ships. Big ships, little ships, you name it. Fishing boats, merchant ships, tankers, etc. The biggest problem was trying to find this guy. We were out looking for him, using air wing assets, using sensors – all the tools of the trade.

Cdr Arthur "Bud" Langston, who had flown 272 missions in the Intruder during the Vietnam War, was the deputy commander (DCAG) of CVW-11:

We got a warning order to target and sink the Iranian Vosper-class frigate *Sabalan*. We had a short time to plan this ASUW operation. We followed standard procedures and prepared an ASUW war-at-sea strike involving two A-6Es and six A-7Es, with an F-14 CAP. The attack aircraft were armed with a mix of weapons, including Harpoons, LGBs, Skipper IIs and Rockeyes for the Intruders, and Walleye IIs and general-purpose bombs for the A-7Es.

On April 18, despite flying a series of SUCAP and reconnaissance missions from just before first light, we could not find the ship. However, the other elements of Operation *Praying Mantis* were well underway, with surface action groups attacking platforms and US forces dealing with Iranian counter attacks.

The veteran Naval Aviator had served as the planner for the attack on *Sabalan*, and he was also supposed to lead the mission. However, by mid-afternoon, it was still nowhere to be found. In his role as strike leader, Langston had been sat in his flight gear on 15-minute launch alert since dawn:

Highly experienced A-6 pilot Cdr "Bud" Langston, DCAG of CVW-11, was a two-tour 272-mission veteran of the Vietnam War. Having previously served with VA-95 as Operations Officer in the early 1980s, he was mission planner for the ASUW phase of *Praying Mantis*. Although Langston never got to target *Sabalan*, the plan was put in to action by an ASUW strike group after he and his B/N hit *Sahand* with a Harpoon, an AGM-123 Skipper, and a GBU-12. (Tony Holmes Collection)

I got a call from the lieutenant that was the squadron duty officer in VA-95. He said, "Deputy, I'm running out of pilots here. We've been running recce missions all day, and would you be willing to fly one?" I replied in the affirmative. When I reported to the ready room, the same lieutenant told me, "We're out of recce weapons-load aircraft, so I need to give you the lead jet you were scheduled to fly during the strike. It's fully loaded". This meant we couldn't land back aboard the carrier without jettisoning some of the ordnance first.

I launched and joined up with two F-14s and an EA-6B, and we had E-2C support. I was flying with my B/N, callsign "Pappy." As we headed for the Strait of Hormuz, the EA-6B passed us a report that "*Sabalan* may be leaving port and coming out to sea." I could not go in the harbor at Bandar Abbas but I could get awfully close because it's very narrow in there, and we were authorized to come through the strait there. Bandar Abbas was on the right side as you came through, and you could orbit in that area. I just basically waited.

We were up high at maybe 15,000–20,000ft, and we saw a frigate coming out of the harbor at high speed, really making a lot of water. The B/N looked with the FLIR and it seemed to be *Sabalan*. However, the visibility was mixed, with sand and haze, and I also knew that the Royal Navy was operating in the region with ships that looked similar. I decided we needed to take a closer look to make sure we had the right ship. We descended, and I passed behind and alongside the ship down its port side at 500+ knots and at an altitude of less than 50ft – so low I was looking up at the mast of the vessel. I could clearly see the Iranian sailors on the ship and the blinking of antiaircraft gunfire, and tracers of the shells passing by. We did not take any hits perhaps due to our speed, but I did fly in such a way that my B/N was on the ship-side of the pass! In addition to AAA fire, the ship also launched several missiles at us. We answered with chaff and flares and pulled off at high speed and climbed.

We told the E-2C of the events that had just taken place in order to make sure that they met our strict RoE – we could retaliate if we were fired on first – when it came to engaging a hostile vessel. I told the E-2C controller I was going to attack, and also to launch the ASUW strike group from *Enterprise*. Then, I went on my radio's Guard channel and told the Iranian ship, "I am going to sink you in five minutes."

We set up for a Harpoon attack with our one AGM-84C, but when we approached the ship in a slight dive, it failed to come off the aircraft. So, we pulled up and reset all of the switches. The second time, the Harpoon worked as planned. We fired it from an altitude of around 2,000ft in a dive at a range of about eight miles from the ship. The missile worked and hit the ship just aft of the bridge. The warhead caused a serious explosion and the frigate billowed smoke from a fire behind the bridge. The vessel soon went dead in the water.

After the Harpoon hit, we followed up with two AGM-123 Skipper IIs. Only one of them hit the target, causing additional damage. After this, at around 1500 [GMT], we

ENGAGING THE ENEMY

Lacking any effective SAMs to defend their ship following Western sanctions, the crew of *Sahand* had had to rely on SA-7 (9K32 Strela-2M) MANPADS since the early 1980s. Although technically capable of hitting an aircraft flying at altitudes up to 14,000ft, the SA-7 is most effective at distances up to 2,600ft. It uses infrared homing guidance to track the heat source emitted by its target, and the weapon has a 1.15kg directed-energy blast fragmentation warhead.

Cdr "Bud" Langston stated that as many as three SA-7-type weapons were fired at "Lizard 500" as he flew down the port side of the frigate at 500+ knots at an altitude of 50ft, and with a separation distance of just 150ft between the aircraft and *Sahand*. He and his B/N had set decoy flares and chaff to be released automatically, with Langston manually deploying more as he broke sharply up and climbed away. A combination of the flares, chaff, and evasive maneuvering successfully defeated the MANPADS.

declared "Winchester" [out of ordnance], called *Enterprise* via the E-2C and passed the ship's location for the rest of the alert ASUW force. We had fuel, so we waited around to act as strike coordinator.

With Cdr Langston already airborne, leadership of the ASUW strike force passed to Cdr Schork:

Once *Enterprise* received word that a Saam-class frigate had been positively identified, CVW-11 was instructed to immediately launch its strike group. Very quickly they said "eight, you are a go," and we all ran out and jumped in our aircraft. My pilot was Lt Cdr

Mark "Needles" Needler, and we launched carrying an anti-ship load of one Harpoon, one Skipper, and one 500lb LGB. "Needles" had been at China Lake and was involved with the development testing of the Skipper, which was a 1,000lb LGB with a Zuni rocket motor to boost range. I had never seen a Skipper before that day, but Needler knew it well. This weapon had a good stand-off capability from any AAA. A normal LGB was dropped from altitude, and it then glided down to the target. The rocket motor on the Skipper allowed it to be fired up to five miles from a target and then fly a parabolic flightpath, culminating with a diving impact on the target.

One A-6 and six A-7s had launched without briefing first. With Langston already over the target, we just basically launched and pushed out as fast as we could, with our throttles all the way forward in "buster" configuration. Langston initiated the first attack as we were inbound from *Enterprise*. Using information from him and the nearby E-2C that was controlling the attack, I was able to find *Sahand* on radar. As we came into range, we could see smoke from the initial attack.

Our plan was to fire the Harpoon and then to come back around for a Skipper shot. Even though we had a missile with a range of up to 70 miles, we decided to fire it at 12 miles. At this point, we got a radio call from someone on board *Joseph Strauss*, instructing us to "Break off your attack. We are going to fire." The ship had also been cleared to engage the frigate with a Harpoon. In our cockpit, "Needles" and I both said "Bullshit, we are pressing the attack," and I politely replied to the ship, "Sorry, we are also in the middle of an attack." We pressed in toward *Sahand* and fired the Harpoon, which flew straight and level.

Due to the heavy moisture content in the Persian Gulf, we were still out of visual range with the FLIR when the Harpoon left the aircraft, although you could see the target with the naked eye because of the smoke trail following Langston's attack. "Needles" flew a 360-degree turn while I reset the switches for the Skipper. My Harpoon had already hit, and I could now see the damaged ship on the TV/FLIR. My intent was to put the laser spot on the target so the Skipper could guide on it. "Needles" flew the profile, and I felt the bomb come off the jet. There was a lot of smoke coming from the ship, so I moved the laser cursor to the stern, where it was not so badly damaged. It did not take very long, and then there was a tremendous explosion – the violence of the explosion from the Skipper impact was amazing.

We still had a 500lb LGB. *Sahand* was burning from end to end, and I could see life rafts in the water on the port side of the ship. We pulled up to a delivery position for the general-purpose LGB, with the A-7s having already completed their attacks. The frigate was by now little more than a smoking piece of junk, and as the senior guy in the cockpit, I took a look at the ship and made the decision to stop the attack. Our job was not to kill the sailors who were clearly just abandoning ship. That's not the way we do business, so I made the decision not to release those final weapons. We also heard from the E-2 that Iranian F-4s were coming out from Bandar Abbas. We decided it was time to go, so we turned and flew at low-level across the UAE for a fast return to the ship.

I had never fired a Harpoon or a Skipper before. However, we had been regularly practicing war-at-sea missions for years in the A-6 community. When the Harpoon came in, it really added a new standoff capability and flexibility to our tactics.

As Cdr Schork explained, *Sahand* was simultaneously hit by an AGM-84C and an RGM-84A, the latter weapon being fired by *Joseph Strauss* of SAG Delta. OS1(SW)

OVERLEAF

With smoke from the Sirri-D GOSP darkening the sky behind it, and surrounded by fishing dhows, the Saam-class frigate *Sahand* is only milliseconds away from being struck amidships by an AGM-84 fired by an A-6E from VA-95 on the afternoon of April 18, 1988. Both of its gun turrets are seen here facing to port, with weapons at near-maximum elevation, having fired at the Intruder as it passed down the warship's port side. *Sahand* was virtually powerless to stop the attack by the lone A-6, as its Seacat SAM system was inoperable and the sensors required to detect the approaching missile were unserviceable.

7

Robert Swain was an operations specialist on board the ship, and he recalled the action leading up to the Harpoon attack:

> On April 18, my general quarters station was that of air intercept controller along with OS1(SW) Dan Maddox and EW2(SW) William O'Conner (who was the EW Department Liaison for Maddox). Immediately after going to general quarters, OS1(SW) Maddox and I took control of an A-6 from VA-95.
>
> *Joseph Strauss* was one of the northernmost US Navy warships in the Strait of Hormuz when we began the engagement with *Sahand*. EW2(SW) O'Conner gave a constant bearing to *Sahand*, allowing OS1(SW) Maddox and myself to vector the A-6 to the target. Once the aircraft was close to *Sahand*, the Iranian frigate began to fire at the A-6. My skipper, Capt Samuel Anderson, instructed me and OS1(SW) Maddox to coordinate with the A-6 crew so that the aircraft and *Joseph Strauss* could conduct a joint Harpoon attack. We instructed the A-6 to follow a bearing and keep its distance so that *Joseph Strauss'* Harpoon would not endanger the aircraft. Once the jet was in position, both Harpoons were fired.

The Bahrain-based Pentagon Media Pool had embarked journalists on board several of the warships in the region in early April as part of the ongoing coverage of Operation *Earnest Will*. When *Samuel B. Roberts* struck a mine, the correspondents that were already at sea quickly found themselves in the frontline of a real conflict. CNN reporter Taylor Henry was on board *Jack Williams* on April 18, and he witnessed the Harpoon launch from *Joseph Strauss*:

> The *Strauss* was directly in front of the *Jack Williams*, maybe a mile or two ahead. From the bridge of the *Jack Williams*, where I stood watching, taking notes and making a cassette recording of the radio transmissions, the sight of the Harpoon lifting off the stern of the *Strauss* was freakish. The missile rose almost gracefully from the ship, came to a near standstill in mid-air just a few feet above deck as it tilted in the direction of the Iranian target, and seemed to undergo a second, mid-air launch, propelling it, from right to left as viewed from the *Jack Williams*, over the water, where it disappeared beyond the horizon. Ten to fifteen seconds later, we saw the flash over the Gulf, and a few seconds after that heard the rumble as the Harpoon struck its target, light of course traveling faster than sound. Over the radio, we heard the frantic shouts of the Iranian crew, screaming in Farsi.

Burning from stem to stern, the battered remains of *Sahand* sit motionless in the Strait of Hormuz. Although the ship had been hit multiple times by both smart weapons (including Harpoons and LGBs) and dumb bombs, it remained afloat – CVW-11's primary goal had been to sink the vessel in just a matter of minutes. Cdr Langston had lobbied for 2,000lb GBU-24 LGBs to be used by the ASUW A-6s and A-7s instead of 500lb GBU-12s, as he knew a warship the size of a Saam-class frigate was going to be difficult to sink. However, Strike Operations officers within CVW-11 stated that smaller bombs were fine. *Sahand* eventually sank several hours after being attacked. (Tony Holmes Collection)

At 1621 hrs, *Joshan* was finally sunk by gunfire from SAG Charlie. *Sahand*, too, was all but lost, the frigate eventually sinking several hours after it had been attacked. However, the primary IRIN target of CJTFME during its day-long war-at-sea was still unaccounted for. This would all change in the late afternoon when *Sabalan*, commanded by Lt Cdr Abdollah Manavi, sailed from Bandar Abbas. Airborne at that time was Lt Cdr Jim Engler in an A-6E, he and his B/N having participated in the Boghammer action earlier in the day:

An A-6E from VA-95 goes searching for Iranian warships during a SUCAP from *Enterprise* on April 18. It was one of six Intruders married up with AGM-84s the day before the war-at-sea, thus ensuring the weapon's interface with the A-6's weapons guidance system. The aircraft is also armed with a single 500lb LGB and two Rockeye CBUs, and it carries 300-gallon centerline and underwing fuel tanks. Crucially, the Intruder could recover back aboard the carrier in this configuration without having to first dump ordnance in order to get down to a safe landing weight. (Tony Holmes Collection)

> After successfully repelling the Boghammer attack, we continued searching for our primary targets – the frigates. Eventually, we had to go to the tanker to refuel, after which we were told to return to *Enterprise*. I requested that our strike package be allowed to continue with the recce mission after tanking, as we were still adequately armed. Having been cleared to proceed, we were vectored to the north, toward Bandar Abbas and Larak Island. After the Boghammer attacks, the chatter on the radio about suspected Iranian F-14s and I-Hawk SAMs was very loud. Our intel was that the Iranians had I-Hawks, and we needed to respect this threat and stay out of the missile's envelope. As we headed north, my B/N looked on the radar.

Joseph Strauss helped the two Intruders locate *Sabalan*, which was attempting to hide amongst commercial shipping – a common tactic used by both Saam-class frigates during the Tanker War. OS1(SW) Robert Swain was in the CIC working with the VA-95 jets:

> While operating under our control, the A-6 crews asked if we would assist them finding *Sabalan*, and we readily agreed. EW2(SW) O'Connor's EW department had briefly picked up surface radar emissions from the frigate a short while earlier, but previous flyovers of the area had only found merchant ships that were anchored at the northern end of the Strait of Hormuz. O'Connor finally got a good bearing from *Sabalan*'s surface radar, and I vectored the two A-6s toward the area where the bearing matched up with surface contacts.

It was now up to Engler and his wingman to pick out the warship from amongst the many boats crowding the water below them:

> I used the FLIR in the center console, and we saw lots of small boats, mostly fishing vessels. We had received some intel from *Joseph Strauss* that a frigate had been sighted near Larak Island. We found a big return among smaller fishing boats, and I used the FLIR to pick it out. I had a photo of *Sabalan* on my kneeboard, and the image came in handy. As we moved from surface contact to surface contact, we came upon a ship that matched

The Oliver Hazard Perry-class frigate *Jack Williams* had been designated as the primary strike ship against *Sabalan* should the IRIN warship challenge SAG Delta in the Strait of Hormuz on April 18. Its crew got to within a minute of engaging the target with a Harpoon before having to break off the attack after receiving a warning that Silkworm ASMs had been fired at *Jack Williams*. (US Navy)

the profile of *Sabalan*. We had the advantage of knowing about the earlier attack by Cdr Langston and the team that had hit *Sahand*. If we found another ship that matched this configuration, it was our target by the process of elimination.

This vessel was heading away from port, and as I was building up my own confidence that we'd found the correct ship, I suddenly saw AAA rounds on the FLIR coming towards us. I reported back that we were taking fire, and that we had found *Sabalan*. I asked if we were cleared to engage, and we received an almost immediate "Affirmative" – just as long as we were sure it was the target.

It was our choice as to what weapon to use, and we decided to deliver an LGB, as we could drop this from higher altitude and high speed, thus allowing us to remain above the smaller AAA and SAM threats. We pushed over into a steep dive and we hit terminal velocity for the A-6E – a little more than 570 knots. This was intentional, as I wanted as much speed on both the bomb and our aircraft in order to evade any threats. We released the LGB, and it guided. While I was in the dive, my wingman saw at least three shoulder-launched SAMs being fired at us. He only informed me of this after the attack. When I asked him why he hadn't told me at the time, he replied that he didn't want to distract me! With my focus being exclusively on the target, I had not seen the missiles.

It looked like the bomb went directly down the stack of the ship into the engineering spaces. We saw a puff of smoke from the center of *Sabalan*, after which it briefly stopped, before turning toward Bandar Abbas trailing an incredible amount of oil. You could see the slick visually and on the FLIR.

We had decided to use the LGB rather than the Harpoon because of the location of the ship relative to Larak Island. When we initially took a look at *Sabalan*, Larak Island was behind it, and I was concerned that the missile might track on the land and not the smaller ship. The way we were oriented, approaching from the south, we could not do anything to remove this challenge. It was, therefore, a simple decision – let's attack with the LGB.

Although Lt Cdr Engler had delivered the knockout blow to *Sabalan*, *Jack Williams* came within a minute of attacking the frigate with a Harpoon missile. Dr. Stephen C. Everly recalled the close encounter in an article he wrote for the US Naval Academy publication *Shipmate*:

> During this time [*Praying Mantis*], I was an ensign stationed aboard *Jack Williams* and was serving as the Communications Officer. Our role in the operation on April 18, 1988 was to be the primary strike ship against the Iranian frigate [*Sabalan*]. [By late afternoon]

our morale was sky high – all the shooting had been done by us, we had not been hit and we had accomplished all of our goals. [About an hour after *Sahand* had been attacked] the second Iranian ship was reported headed our way and was initially engaged by an A-6 with an LGB and badly damaged.

We were about a minute away from launching our Harpoon [at it] when an EA-6B reported seeing Silkworm missiles launched towards our position. To say this alarmed people would be to put it mildly – the Silkworm missile carries about 1,100lbs of high explosives, which makes it about four times the size of an Exocet. In all, about five missiles were launched towards us, with targeting data for them being provided by the frigate before she was hit, and by a [IRIAF] C-130 afterwards. We immediately put the after end of the ship towards the missiles and ran at 30 knots away from them. When the Captain announced over the 1MC that there were incoming missiles, about half of the crew hit the deck and remained there. On the bridge, we were trying to spot them so we could engage them with hand-carried Stinger missiles. As we maneuvered, we fired chaff into the air to decoy the missiles, and this seemed to work as we were not hit.

About five minutes passed before we were sure that the missiles had missed, although when the CO said over the microphone "0.50-caliber gunners and Stingers, take the missile inbound port quarter" everyone figured that we were going to eat one. After all, trying to hit a 550mph missile with a machine gun is definitely a last resort. The flightdeck crew for our helicopter saw the last missile as it passed about three miles astern of us and completely demolished a stationary oil rig. Needless to say, once we were clear of the missiles' range, our tension factor decreased by a thousand percent.

Prior to *Praying Mantis*, the US government and the Pentagon had warned Iran that the firing of Silkworm ASMs at US Navy warships would cause retaliation, with strikes on missile launch sites in Iranian territory. However, senior officers at the Pentagon and at US Central Command (which controlled all military assets in-theater) stated that there were no Iranian Silkworm attacks on April 18, 1988. This was possibly said to prevent the one-day war-at-sea from escalating into a fully blown conflict.

While the crew of *Jack Williams* was dealing with the Silkworm threat, Lt Cdr Engler was pressing for the destruction of *Sabalan*:

When the ship was limping back to port, we did call through the E-2, which linked up the battle group commander, CJTFME HQ and all the way up to the Secretary of Defense, Frank Carlucci. We said we still have two Harpoons [one of which was under the wing of Webb's jet] and could make another run, for the ship is now well away from the island. They came back and told us, "Negative, return to ship!"

Additional aircraft were also en route from *Enterprise* to sink the frigate when a "knock it off" call came directly from the Pentagon, the Reagan administration feeling that a point had been proven to the Iranians. *Sabalan* was towed back into port by three tugs, the frigate trailing a five-mile-long oil slick behind it, and the *Enterprise* battle group continued to monitor things in the Persian Gulf. *Praying Mantis* was widely viewed within the US Navy as how to do business during a war-at-sea, being seen as a measure of vindication for warfighting improvements since the early 1980s.

FURTHER READING

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A-6E Intruder cover artwork
The crew of VA-95 A-6E "Lizard 500" fire their AGM-84C at *Sahand* after being targeted by AAA and MANPADS during a high-speed pass down the port side of the frigate on April 18, 1988. Seconds earlier, the pilot of the aircraft, Cdr "Bud" Langston, had told his mission controller onboard a nearby E-2C that, "He shot at me. I'm now 12 miles out and I have just launched a Harpoon missile. I'm waiting for it to hit." (Artwork by Jim Laurier)

***Joshan* cover artwork**
The Kaman-class fast attack craft *Joshan* of the IRIN fires the only Harpoon missile to ever be shot in anger at an active US Navy warship. The weapon only narrowly missed the cruiser *Wainwright*, whose crew employed chaff and EW jamming to defeat the RGM-84's terminal guidance system. (Artwork by Jim Laurier)

Title Page
An RGM-84 is fired by the destroyer *Joseph Strauss* from its single-arm Mk 13 Mod 0 GMLS at the Iranian frigate Sahand at 1540 hrs on April 18, 1988. This photograph was taken by GMM3 David Greenwood, who told the author, "I went up into the safety observer's booth, which was inside the launcher control compartment [for the Mk 13 Mod 0 GMLS] and stuck up above the deck, to observe the missile launcher and get photos of the Harpoon launch. I remember having a hard time holding my camera steady because of the adrenaline and excitement of what we were doing. When the missile launched, I just jerked the shutter button. I had no idea if I had gotten the shot until after I had the film developed." (David Greenwood)

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